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CLEAN WATER FOR THE 1970;S: A STATUS REPORT

Federal Water Quality Administration
Washington, D. C.

June 1970

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Clean Water for the 1970's

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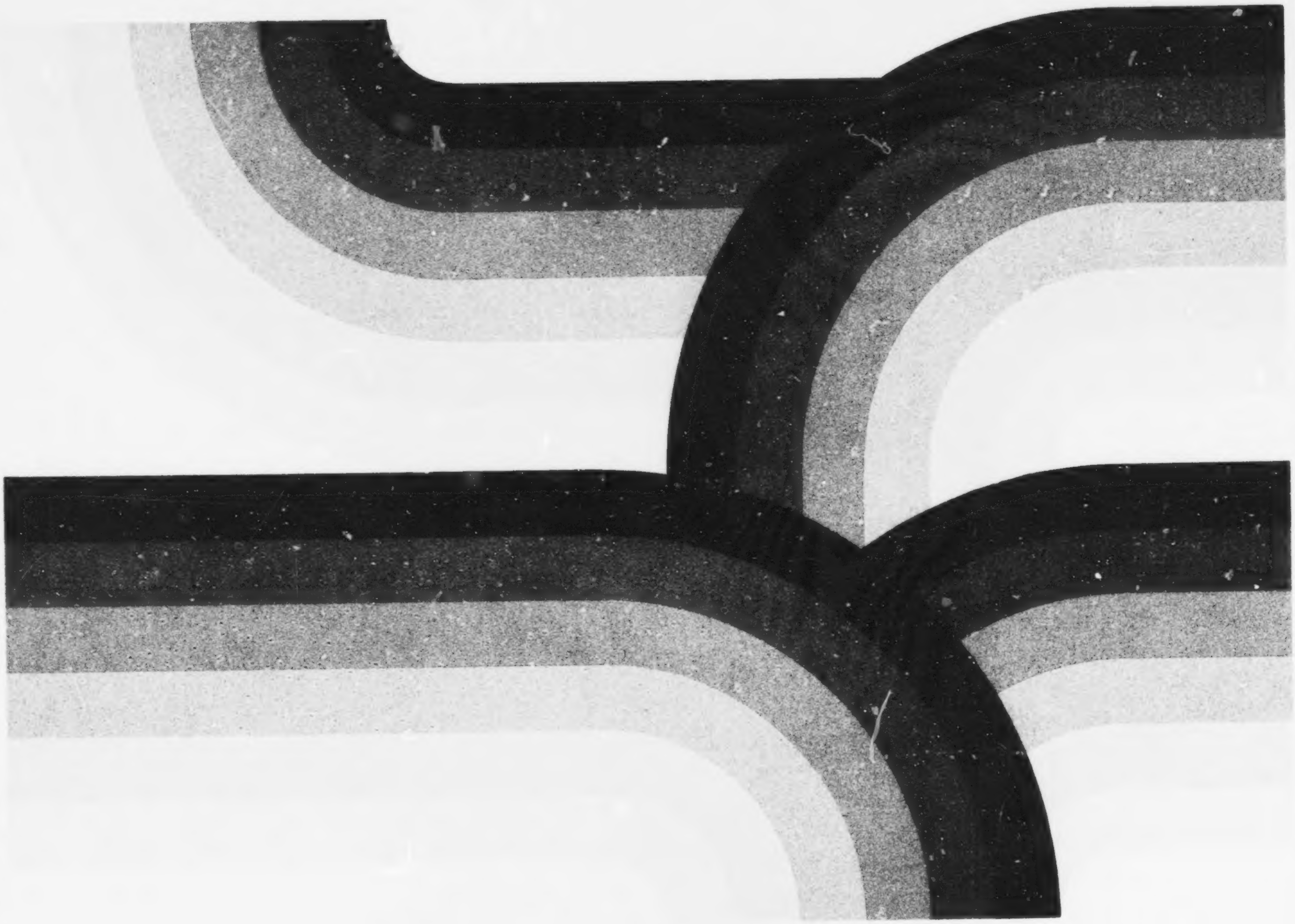

A STATUS REPORT

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U.S. DEPARTMENT OF THE INTERIO [illegible] WATER QUALITY ADMINISTRATION

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DEPARTMENT of the INTERIOR

news release

FEDERAL WATER QUALITY ADMINISTRATION Hoffmann 557-7362

For Release Thursday, July 2, 1970

FIRST ANNUAL REPORT GAUGES PROGRESS MADE IN CLEANING UP NATION'S WATERWAYS

Secretary of the Interior Walter J. Hickel today announced the release of the first annual report developed by Interior's Federal Water Quality Administration to gauge the progress being made in cleaning up the Nation's waterways.

Secretary Hickel said, "This report was undertaken at my direction so that we could better assess the effectiveness of our water pollution control efforts and to learn what must be done to improve the program."

He added, "The 1969 report establishes for the Congress and the American people a benchmark from which to work in cleaning up our waters in the next decade -- a decade which gives every indication of becoming the environmental decade. The environmental dangers we face are uniting increasing numbers of Americans -- young and old, rural and city dwellers. We all face a common challenge: to demonstrate that we can have the benefits of economic prosperity without surrendering the environment in which we live to destruction and decay."

The report also describes legislative and administrative changes needed to make water pollution programs more effective in the 1970's. Secretary Hickel noted that while $1.5 billion in Federal grants have been awarded to aid in the construction of $6.4 billion worth of municipal treatment facilities, "treatment has not kept pace with development."

As a means of correcting this situation, the Nixon Administration has proposed legislation that would provide $4 billion in Federal funds to help finance a four-year, $10 billion program for construction of municipal waste treatment plants. Secretary Hickel said that this funding would be assured, as proposed, so that communities would not have to plan facilities on the basis of money authorized only to see it not appropriated.

In addition, new administrative rules have been proposed that will require that projects receiving Federal aid be part of an overall basin-wide and regional water pollution abatement plan. Such approaches are expected to lead to a more systematic development of municipal waste treatment facilities.

While the pace of enforcement activity has quickened, with five new enforcement conferences called since January 1969, tougher standards and extended enforcement authority are needed, the report says. It notes that new legislation introduced by the Administration would provide fines of up to $10,000 a day for each day of violation following 180 days after notice of water quality standards violation or following an enforcement conference notice of violation.

Effluent standards would also be established to control municipal and industrial discharges, and Federal jurisdiction for enforcing water pollution abatement laws would be expanded beyond interstate and navigable waters to include boundary and ground waters of the United States, waters affected by pollution in the contiguous zone which extends nine miles beyond the three-mile limit, and in the high seas when they are contaminated by United States discharges.

The report also details how newly enacted legislation or executive orders tighten controls over oil and pesticide pollution and pollution originating at Federal installations.

The report emphasizes the need for environmental planning to curb pollutional abuses that could result from new developments such as nuclear power plants, oil pipelines, and the building of airports in or near wildlife refuges.

Copies of the report can be obtained by writing to the Public Information Office, Federal Water Quality Administration, Washington, D.C. 20242.

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DEPARTMENT of the INTERIOR

news release

FEDERAL WATER QUALITY ADMINISTRATION Hoffmann 557-7362

For Release Thursday, July 2, 1970

TWO NEW BOOKS ON APPLYING WATER POLLUTION CONTROL TECHNIQUES PUBLISHED

Two new reports covering applied techniques in water pollution control have been written by employees of the Department of Interior's Federal Water Quality Administration.

Kenneth M. Mackenthun, Chief of FWQA's Technical Studies Branch, who wrote "The Practice of Water Pollution Biology," said the book is for biologists inexperienced in field investigative techniques and data analyses, for sanitary engineers, chemists, attorneys, and water pollution control administrators.

T.A. Wastler, Chief of the Physical Sciences Section, Estuarine and Oceanographic Branch, has written "Spectral Analysis." It is a basic handbook on advanced mathematical techniques new in water pollution control, but used for some time in oceanography and the space sciences in analyzing such problems as wave motion or the calculation and correction of spacecraft orbits.

"The Practice of Water Pollution Biology" may be obtained for $1.50 a copy by writing to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 20402, GPO Catalog I678:W29.

Copies of "Spectral Analysis" may be obtained without charge by writing to the Federal Water Quality Administration, Public Information Office, Washington, D.C., 20242, while the supply lasts.

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# # #

CLEAN WATER FOR THE 1970's

A Status Report

June 1970

CLEAN
WATER

WALTER J. HICKEL
Secretary of the Interior

CARL L. KLEIN
Assistant Secretary for
Water Quality and Research

DAVID D. DOMINICK
Commissioner,
Federal Water Quality Administration

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FOREWORD

"America, the Beautiful" is not just a song. It is an ideal that Americans have long cherished—and taken for granted. During the 1960's, we realized with growing alarm that this ideal was being threatened by pollution from an increasing number of sources. We began to understand that the benefits of technology would hold little value unless they could be enjoyed in decent and healthy surroundings. President Nixon expressed the national concern for environmental quality when he declared that "the 1970's absolutely must be the years when America pays its debt to the past by reclaiming the purity of its air, its waters and our living environment. It is literally now or never."

Awareness of the danger to our way of life has created a climate for constructive action by all levels of government, industry and private citizens. The Department of the Interior is the agency of the Federal government charged with the major responsibility for managing and conserving our Nation's natural resources. Department programs encompass a wide range of environmental concerns and directly affect fish and wildlife, water, minerals, land, parks and other resources. Increasing population and growing per capita demands on these natural resources call for careful and imaginative management.

Among Interior's varied missions, water pollution control is one of the most important and demanding. Over the past year, much of the Department's efforts and my own energies have been devoted to meeting this responsibility. We have been involved in formulating the President's legislative program; in working with student organizations concerned about environmental enhancement; in mapping out protective programs for the Great Lakes; and in controlling oil spills. We have focussed on important environmental issues across the Nation to prevent further damage to our national heritage. The Department has had a major role in in reviewing the development of Alaska's vast petroleum resources, and in assuring that proper measures will be taken to protect the sensitive tundra and other environmental values. At the other end of the Nation, the Department is studying ways to protect the South Florida environment as increasing development occurs and to preserve the State's unique Everglades in the face of construction of a large jetport. Water quality protection and enhancement has been of central concern in all these issues.

Even greater challenges for enhancing water quality will face the Department of the Interior and the Federal Water Quality Administration in the years ahead. We must continue to revamp existing programs to make more effective use of our present authorities. We must prepare to implement the Water Quality Improvement Act of 1970 and to carry out the Department's responsibilities under the National Environmental Policy Act of 1969. We must also be ready to respond to new responsibilities stemming from the President's legislative proposals.

This status report of the Federal Water Quality Administration describes the agency's past activities and future plans. The entire field of water pollution control is changing so rapidly that some aspects of the report may be outdated almost before printing is completed. It is a snapshot of the situation at this point in time, of a situation which is dynamic and fluid. Nevertheless, I believe this report will be of great use to the Congress and the American people in describing the point of departure from which we are moving to rescue our water resources in the decade of the 1970's.

Walter J. Hickel

WALTER J. HICKEL

CONTENTS

iii **Foreword**

iv **Introduction**

1 **Water Pollution and the Environment**

4 Municipal Wastes
5 Industrial Wastes
6 Thermal Pollution
8 Oil and Hazardous Substances
9 Mine Drainage
10 Sedimentation and Erosion
12 Feedlot Pollution
13 Other Agricultural Wastes
13 Wastes from Watercraft

15 **A Water Pollution Control Program for the 1970's**

15 Better Financing of Municipal Treatment
16 Better Standards and Enforcement Authority
16 Better Assistance to the States
17 Better Programs for Pollution from Federal Activities
17 Programs to Deal with Emerging Problems

19 **Programs for Water Pollution Control**

19 Regulatory Programs
  19 Water quality standards and enforcement
  24 Control of oil pollution
  28 Control of vessel wastes
  29 Control of pollution from federal activities
  31 Control of pollution from federally licensed and supported activities
34 Assistance Programs
  34 Assistance to municipalities
  38 Assistance to industry
  39 Assistance to state and interstate programs
  41 Technical Assistance
43 Planning and Basic Studies
  43 Environmental planning
  46 Basin and regional planning
  49 Estuarine and coastal studies
  52 Data and information
  54 Economic studies
55 Research, Development, and Demonstration Programs
  57 Municipal pollution control technology
  59 Industrial pollution control technology
  60 Agricultural pollution control technology
  60 Mining pollution control technology
  61 Control of pollution from other sources
  62 Water quality control technology
  63 Waste treatment and ultimate disposal technology
  64 Water quality requirements research
64 The Human Element
  65 Informing the American public
  66 Working with youth
  68 Training and manpower development
72 International Activities

75 **Organization, Resources, and Facilities**

75 Organization
77 Personnel
77 Facilities
78 Budgetary Resources

INTRODUCTION

Many signs point to the 1970's as the "environmental" decade—when the American people and their institutions begin to take full stock of the precious environmental resources of this Nation and to measure some of the cost of the Nation's economic and social growth in terms of the destruction of those resources. The challenge of the 1970's will be to demonstrate that society can have the benefits of urban and industrial growth without necessarily having to live with the destruction.

This challenge is one which is uniting increasing numbers of Americans—old and young, rural and city dwellers. As President Nixon has said, "The environmental problems we face are deep-rooted and widespread. They can be solved only by a full national effort embracing not only sound, coordinated planning, but also an effective follow-through that reaches into every community in the land."

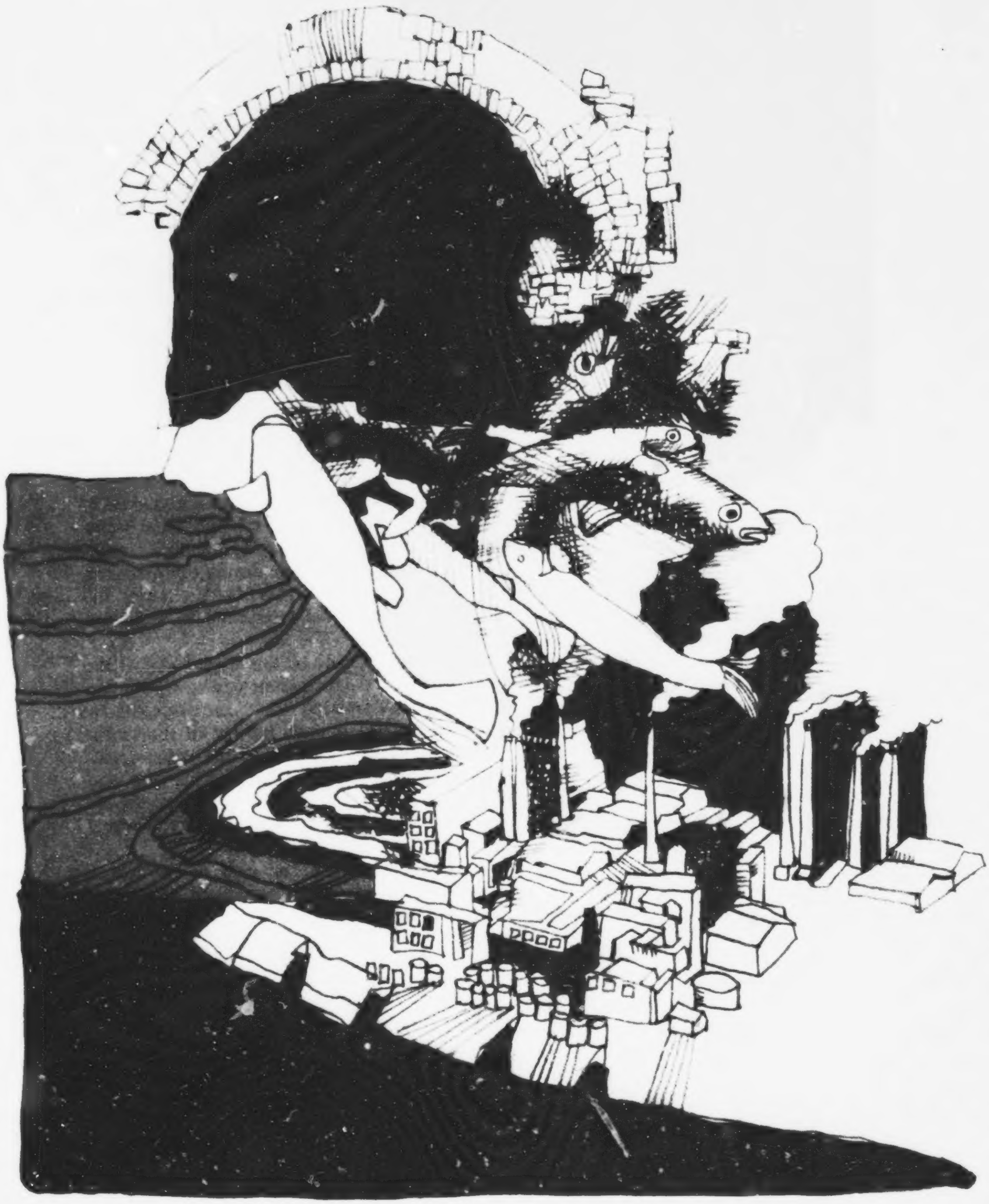
Water pollution control is one of the major aspects of environmental protection and enhancement. Congressional recognition of the importance of water quality protection was reflected in the passage of the first permanent Federal legislation, the Federal Water Pollution Control Act, in 1956 and the subsequent strengthening amendments in 1961, 1965 and 1966. Since 1966, the primary responsibility for carrying out the Federal programs in water pollution has rested with the Federal Water Pollution Control Administration, operating under comprehensive legislation embodied in the Federal Water Pollution Control Act, as amended. Originally part of the Public Health Service and subsequently a separate office in the Department of Health, Education and Welfare, in 1966 the program was transferred to the Department of the Interior. This added new vitality to the ties of water pollution control with other resource management programs in the Department of the Interior and with the effort to provide greater opportunities for all Americans to enjoy outdoor recreation, fishing and parks. Passage of the Water Quality Improvement Act of 1970 resulted in a new name for the agency, the Federal Water Quality Administration (FWQA), which stresses the more positive aspects of the program.

Secretary Walter J. Hickel has stressed his commitment to cleaning up polluted waters and preventing further pollution as one of the primary tasks facing the Department of the Interior. In an appearance before the Committee on Public Works, House of Representatives, in March 1969, the Secretary stated that, with "improved legislation, effective and imaginative administration, adequate financing and tough enforcement, the objectives as outlined by Congress (to achieve positive protection and enhancement of the Nation's waters) can and will be attained." The Secretary also promised to the Committee that he would direct FWQA to prepare a report to be submitted to the Congress each year outlining the progress that had been made by the Federal government working in cooperation with its partner agencies in the States and localities.

The purpose of this first annual progress report is to provide a groundwork for understanding the nature of the Federal and State water pollution control programs, to detail the progress which has been made during the first year of the Nixon Administration, and to assess the measures which will be required to fulfill the challenge of the 1970's.

An important part of this assessment is the impact of the significant new water pollution control legislation that has been proposed by President Nixon, as well as that of the recent enactment by the Congress of the Water Quality Improvement Act of 1970. This new and proposed legislation will greatly increase the capability and responsibilities of the Federal water pollution control program.

In many ways, the first year of the Nixon Administration may be considered a time of analyzing progress and capabilities—of taking stock of the Federal water pollution control program and determining what significant new measures or legislation would be needed. This process resulted in several major proposals aimed at strengthening the Federal program and improving the quality and scope of Federal assistance to the States and localities, which President Nixon described to the Congress in his 1970 Environmental Message. These proposals reflect the major new thrusts needed in the Nation's effort to abate and prevent pollution in the coming decade.



WATER POLLUTION AND THE ENVIRONMENT

Almost any day, in the waters near any large population center in the United States and, increasingly, in the countryside, we can see the signs of water pollution. It comes from many sources and exists in many forms to assail the eyes and the nose and the taste buds. Standing by the banks of an urban river—if one can actually get past the warehouses and wharfs and weeds to see the river—pollution may appear as surface oil slicks, in which old tires and debris and someone's picnic remnants are trapped and float sluggishly by, or as the public health notices warning the citizen not to swim or wade in the water at his feet. Pollution may be manifested in less obvious ways by masses of aquatic weeds and bad taste in the drinking water supplies. Even more subtle will be the—often unseen—changes in the aquatic life of the river, the loss of sport fish and the ascendence of sludge worms and other "tolerant" life-forms such as carp.

This urban example is repeated throughout the Nation. As our society and economy have grown, the wastes generated by our population and our technology have caused staggering amounts of pollution. Use of our waters to receive and carry away wastes has seriously damaged our ability to enjoy other water uses, such as swimming and boating, sport and commercial fishing. Other water uses, such as domestic, agricultural and industrial water supply, are possible, but often only after considerable advance treatment. Growing public awareness and concern with mounting pollution of the Nation's streams, lakes and coastal waters have stimulated a vast and vigorous national effort to control and abate water pollution.

Water quality problems caused by pollution are prevalent in every region of the country. The two areas where water quality and uses have been most seriously damaged are in the Northeastern States and the Great Lakes. In the Northeast, tremendous urban and industrial growth occurred during the 19th and early 20th centuries when little or no provision was made to control municipal or industrial waste flows to surface waters; the water was expected to "purify itself" and the wastes would float on downstream to become someone else's problem. The result was a legacy of pollution. The Northeastern States have the largest amount of untreated municipal and industrial waste discharges and the largest backlog of waste treatment facility needs.

In the Great Lakes, the discharge of large volumes of wastes, principally from municipal and industrial sources, has greatly accelerated the natural aging process of lakes. The most seriously affected of the lakes, Lake Erie, is now in a state of advanced eutrophication or aging—choked with plants, algae and other organic material. Although Lake Erie is not, as some experts have asserted, "dead," it is certain that very great expenditures for water pollution abatement are necessary to restore the fishery of the lake and reopen beaches closed because of pollution.

There are a number of other pollution problems caused by certain industries and sectors of the economy which have led to serious water quality damage in other parts of the country. Animal wastes from feedlots or runoff from irrigated and fertilized fields and areas where pesticides are used are an increasing cause of pollution, particularly in the Midwest and Southwest. The Colorado River becomes more saline every year as a result of irrigation return flows full of salts leached from the fields. The Annual Federal Water Quality Administration (FWQA) report on *Pollution Caused Fish Kills* chronicles the tremendous aquatic life mortality from agricultural pollution in Kansas and Missouri.

Acid drainage from abandoned mines has destroyed life in many streams in Appalachia and the Ohio Basin generally. Domestic and vessel wastes have polluted many coastal waters where sensitive shellfish were harvested; each year more areas are closed to private and commercial harvesting. Oil spills from vessels and leaks from offshore oil drilling facilities have resulted in several spectacular oil pollution incidents in the last few years, among them the TORREY CANYON and OCEAN EAGLE spills, the Santa Barbara offshore well leaks and the recent fire and oil leaks from drilling in the Gulf of Mexico. Less spectacular oil spills are occurring almost daily in navigable waters across the Nation.

How Has All This Pollution Happened?

Population growth is one major factor. In 1967, the Nation's population passed the 200 million mark. This number of people is expected to double in the next 50 to 60 years. Staggering demands will be placed on our natural resources to support this population. Waters are needed for consumptive purposes, such as public water supply, food production and processing, and some industrial uses, as well as for non-consumptive uses, such as reaction, industrial cooling, and sport and commercial fishing. At the same time that demands for water will increase, so will production of wastes that threaten the environment.

Not only the rate but the pattern of population growth concentrates and magnifies pollution. Urban and suburban sprawl covers green spaces and reduces clean environment in the very areas where people most need it. Intensive development has occurred particularly along the Nation's coastline, in the very estuarine areas that are most sensitive to environmental degradation.

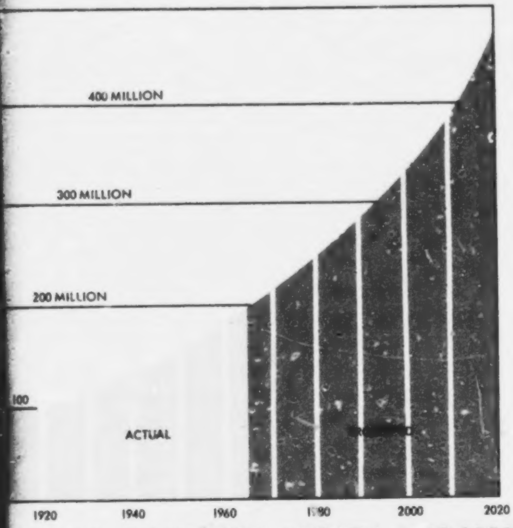
Higher individual incomes and expectations have led to increasing demands for food and consumer goods, for better housing and highways, for a whole range of conveniences. In most cases, production of wastes is "built in" to our technology; as industrial production increases, with attendant damands for water, so does the per capita production of wastes. The public's demand for "throw-away" containers and other convenience items, as well as the tendency toward planned obsolescence, further accelerate this trend.

Consumer use and production of goods have greatly increased the demand for electric power—power production has doubled every ten years since World War II and this rate is expected to increase. Great amounts of water are used in producing electricity, and waste heat from both fossil fueled and nuclear generating plants constitutes a serious, and increasing, threat to the Nation's waters. For example, the famous salmon runs of the Pacific Northwest are threatened by thermal pollution.

Not only is the volume of industrial production increasing, but the very complexity of the products and wastes creates severe challenges for waste treatment technology. New chemical products are coming on the market every day, most often without sufficient research into the environmental consequences of using them. Widespread use of detergents has led to great increases in the release of phosphate nutrients to the waters, stimulating tremendous and noxious growths of aquatic weeds which cause severe problems in many areas. Radioactive and physiologically-active chemicals, which pose vexing problems, can only increase. Effects which cannot be predicted may be profound and irreversible.

Mining and transporting natural resources also pose increasing dangers for the environment. Greater use of supertankers and pipelines to transport oil and other materials, as well as increasing use of offshore and underwater mining, will greatly increase the dangers of accidental oil pollution and other hazards.

The growing popularity of deep well disposal of wastes presents yet another serious threat to our water resources. Although in some cases carefully controlled deep well injection may contribute to groundwater management, im-



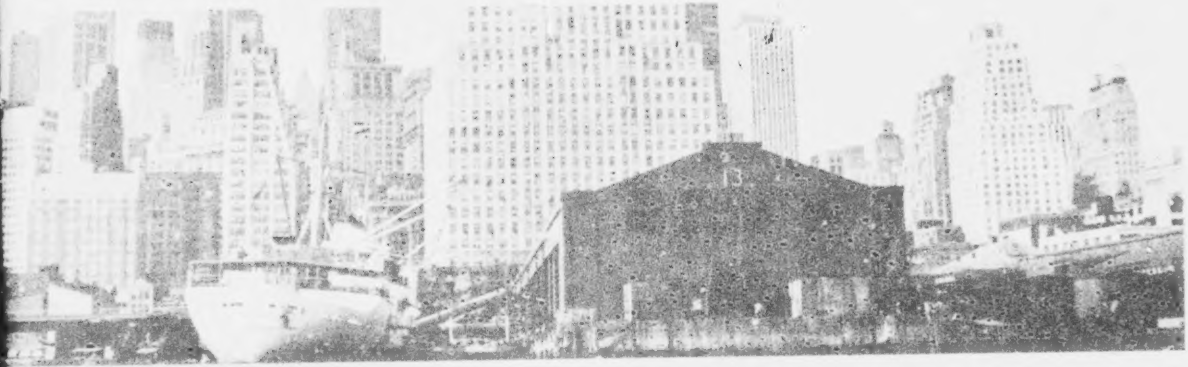
U.S. POPULATION GROWTH 1910-2020

properly carried out, this method of disposal may result in the contamination of groundwater or interconnected surface water supplies. The greatest problem in dealing with subsurface disposal is that the effects of underground pollution and the fate of the injected materials are uncertain with the limited knowledge available today.

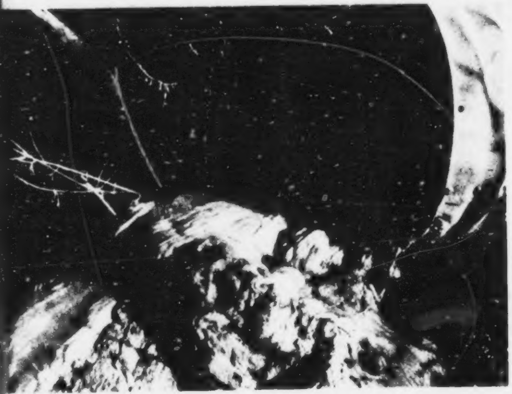
Production of greater quantities of better quality food for American citizens has caused increasing pollution problems. Higher agricultural productivity has been based on irrigation and use of chemical fertilizers and pesticides. Runoff carries salts and chemicals, many of which are highly toxic and have long-lasting environmental effects, into streams. These diffuse waste sources are most difficult to control or treat. The possibility of irreparable and disastrous ecological consequences, particularly from persistent pesticides, has led to increasing demands for controlling or eliminating their use; no one can predict with certainty the impact of such a move on agricultural productivity.

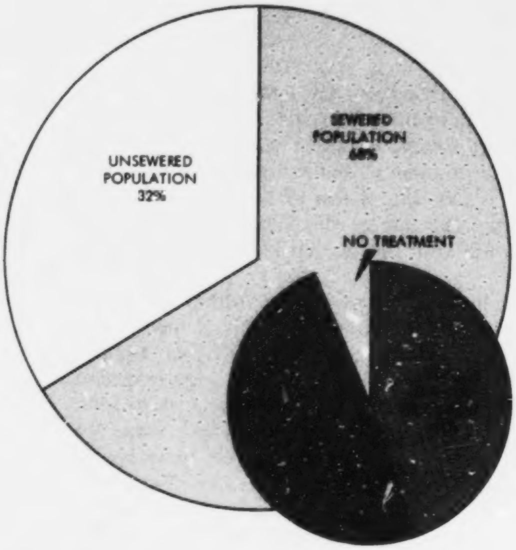
Population growth and greater prosperity have brought a rising demand for beef and other meats. To increase productivity and profits, the trend has been toward raising heavier livestock and concentrating animals in large feedlots, thereby increasing and concentrating the agricultural waste problems.

In summary, neither the institutions nor the technology of our society has been effectively utilized to prevent widespread pollution from occurring. To provide a better understanding of the specific challenges that control of pollution involves, the sources of pollution are discussed in greater detail in the following sections. These discussions will provide some indication of the magnitude of these sources of pollution and the estimated dimension and costs of clean-up.



The New York Skyline, viewed across the polluted Hudson River, exemplifies the growth and concentration of population and waste in the Nation's cities. Huge outpourings of wastes must be treated to improve water quality.





Aquatic growths, forming dried cakes along a lake shore, are caused by excessive nutrients in wastes and constitute a major aesthetic nuisance.

Municipal Wastes

The two largest sources of waste discharges to the Nation's waters are sewered municipal wastes and industrial wastes. Besides being a large source of organic material, which lowers the dissolved oxygen content of water and increases the concentration of bacteria, municipal waste also contains nutrients that fertilize algae and thus accelerate eutrophication of lakes.

Today, the number of sewered communities in the United States is just under 13,000; 68% of the Nation's population lives in such communities. Raw or inadequately treated sewage from millions of people still flows into our streams. Fortunately, we have the technological knowledge to deal effectively with municipal wastes. However, this technology has not been applied to the extent needed to prevent pollution. Although many communities have been installing and improving their waste treatment facilities, over 1000 communities outgrow their treatment systems every year.

The economic analyses contained in the FWQA's annual report to the Congress on the costs of clean water indicate that only about 40% of the Nation's treatment systems are adequate. An estimated 46% of the sewered population is now served by treatment plants that are overloaded or in need of major upgrading. Seven percent of the sewered population lives in communities which provide no treatment.

Generally speaking, the greatest municipal waste problems exist in the areas with the heaviest concentrations of population. Past neglect, however, has led to a greater backlog of waste treatment facility needs in the Northeast than in other parts of the Nation. The six New England States, New York and Pennsylvania contain just over 20% of the Nation's population but 52% of the sewered population that is not provided with waste handling facilities.

The cost studies indicate that a major investment, totalling about $10 billion, will be necessary over the next five years to overcome this legacy of neglect and achieve adequate levels of treatment for the Nation's municipal wastes. After that, significant annual investments will still be necessary to expand and replace plants as population growth continues. Treatment of domestic-type wastes from Federal facilities will also require significant expenditures by Government agencies; the waste treatment needs for sanitary and other wastes generated by Federal sources have been estimated at $246.5 million.

The waste loads from municipal systems are expected to increase nearly four times over the next 50 years. Even if municipal and industrial waste loads are substantially reduced through treatment, pollution problems may continue to exist in densely populated and highly industrialized areas where the assimilative capacity of receiving waters is exceeded. In these areas, higher and higher levels of treatment, approaching 100%, will probably be necessary, and water supply demands will lead to ever increasing use of renovated wastewaters.

Other municipal waste problems that will become more apparent as conventional treatment reduces the load of organic wastes are those caused by storm or combined sewers and by nutrients which are not removed by conventional treatment. Many cities have combined sewers which discharge raw sewage along with street runoff directly to streams when sewer overloads occur during storm or thaw periods. Although combined sewer problems exist to some extent in most regions of the country, the distribution of severe problems is heaviest in the Northeast, Midwest and, to some degree, in the Far West. In the older cities of the Northeast and Midwest, principally New York, Rochester, Detroit, Cleveland, Chicago and Boston, which have high population densities and are heavily industrialized, the problems are the most difficult and the most costly to solve. Even where sewers are separated, pollution may result from storm sewer discharges carrying a variety of wastes from the streets.

The most vexing problem in water quality management is the condition that results from the addition of excessive amounts of nutrients, principally nitrogen and phosphorus compounds. Although these elements are needed in small quanitites to produce food for aquatic animals, excess amounts result in overfertilization and alteration of the aquatic system. The resulting algae blooms are particularly noticeable in lakes and in streams where water moves slowly.

Although some nutrients reach waters from agricultural runoff, municipal wastes contribute the major load. Already nutrient pollution has led to the imposition of very high treatment requirements for waste discharges to the Great Lakes and several other areas; the cost of meeting these requirements is included in the investment totals noted above. In future years, the need for nutrient removal at other cities will greatly increase the costs of waste treatment.

Industrial Wastes

Industries discharge the largest volume and most toxic of pollutants. Industrial waste discharges are the source of an enormous variety of materials found in our water. Our 1969 report, *The Cost of Clean Water and Its Economic Impact,* listed a total of fifty-one agents being introduced into our Nation's waters as a result of industrial processes—and the list is known to be partial rather than comprehensive. For purposes of quantification, the common substances can be reduced to two general classes of materials, settleable and suspended solids and oxygen demanding organic materials. Major water-using industries are believed to discharge, on the average, about three times the amount of each class of waste as is discharged by all of the sewered persons in the United States.

There are over 300,000 water-using factories in the United States. Although there is as yet no detailed inventory of industrial wastes, general indications are that over half the volume of the wastes discharged to water comes from four major groups of industries—paper manufacturing, petroleum refining, organic chemicals manufacturing and blast furnaces and basic steel production.

The areas where the greatest quantities of industrial wastes are discharged to water are the Northeastern States, the Ohio River Basin, the Great Lakes States and the Gulf States. Lesser, but significant, volumes of industrial wastes are discharged in some areas of the Southeast and in the Pacific Coast States. Like municipal wastes, industrial waste sources are concentrated in certain areas, for factories, like people, tend to be found in clusters.

The volume of industrial wastes is growing several times as fast as that of sanitary sewage as a result of the growing per capita output of goods, declining raw materials concentrations and increasing degrees of processing per unit of product. Given the necessary expenditures, a large percentage of this volume can be treated efficiently, much of it, after pre-treatment in some cases, in the municipal treatment system. Whereas factories which used large volumes of water traditionally discharged wastes directly back to the stream, more stringent pollution control requirements and cost factors have led to increasing use of public treatment systems by a variety of industries. Most wastes from food-processing industries can be treated in public plants, and wastes from paper and pulp mills, chemical, pharmaceutical, plastics, textile and rubber plants have successfully been treated in municipal plants. Some combinations of municipal and industrial wastes actually improve the treatment process by, for instance, reducing the nutrients in waste discharges.

Increased use of joint municipal-industrial treatment systems will facilitate abatement of industrial pollution, and feasible treatment processes have been developed for many types of industrial wastes. Although the lack of an industrial waste inventory makes estimates difficult, the increasing level of investment in industrial treatment facilities appears indicative of progress towards meeting water quality standards. FWQA's economic studies have estimated the annual investment need for manufacturing industries at $650 million for each of the next five years.

Although, overall, this continued level of investment for treatment of present industrial pollution is encouraging, certain types of industrial pollution present much more complex abatement problems. The trends towards increasing production and use of complex chemical products and radioactive materials have greatly increased the possibility of releasing exceedingly dangerous wastes to the environment. Many of the new chemicals are a challenge to detect, much less control. There is fear that too little caution and study precede the processing or marketing of these materials.

This municipal discharge carried domestic sewage and industrial wastes into the Missouri River.

Thermal Pollution

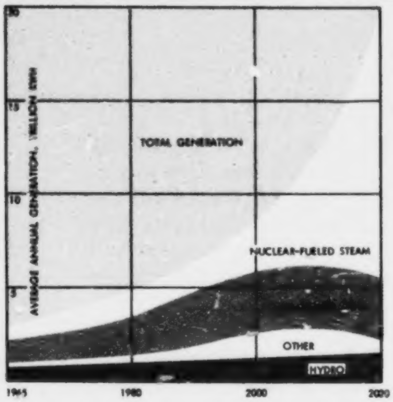
The growing demands for electric power will require a tremendous expansion of power generating facilities. Water is used in the production of almost all electric power now generated —whether by hydroelectric, fossil fueled or nuclear power plants. Two of these generating methods, fossil and nuclear fueled steam electric plants, produce large amounts of waste heat.

As the amount of waste heat from steam electric power plants discharged to water bodies has increased, concern over thermal pollution and its effects has increased. As usually defined, thermal pollution means the addition of heat to natural waters to such an extent that it creates adverse conditions for aquatic life; accelerates biological processes in the streams, reducing the dissolved oxygen content of the water; increases the growth of aquatic plants, contributing to taste and odor problems; or otherwise makes the water less suitable for domestic, industrial, and recreational uses. Not the least important of the effects of heated wastewater is the reduced utility of the water for further cooling. An increasing number of authorities are beginning to believe that this waste heat may be the most serious contemporary source of water pollution.

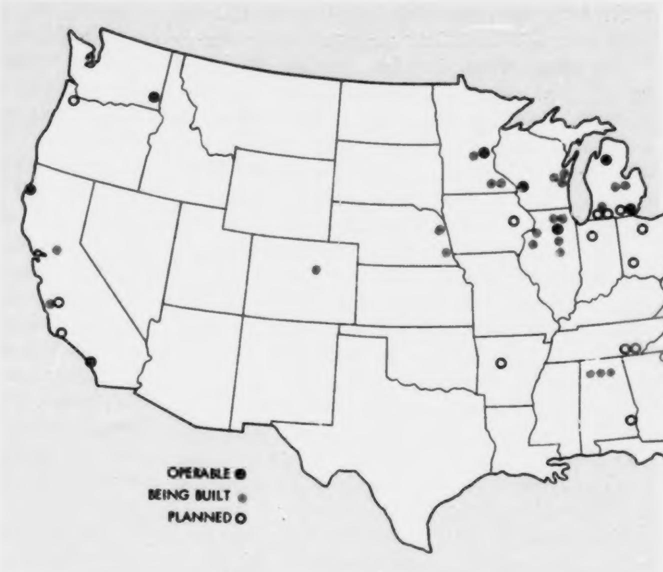
The electric power industry is one of the most dynamic industries in the United States, and it has had a growth rate which has exceeded that of the gross national product for a number of years. The technology of electric power generation and distribution is changing rapidly. Larger-sized units have become economically feasible because of load growth and the increasing inter-connection and coordination of power systems via extra high voltage transmission facilities. In recent years, a large number of nuclear fueled plants have been planned and put under construction.

The principal use of water in stream electric generating plants is for condenser cooling purposes. The amount of water required for condenser flows depends upon the type of plant, its efficiency, and the designed temperature rise within the condensers. The temperature rise of cooling water condensers is usually in the range of 10° to 20° F, and the average rise is about 13° F. Currently, large nuclear steam electric plants require about 50% more condenser water for a given temperature rise than fossil fueled steam electric plants of equal size. It is estimated that by 1980, the electric power industry will use the equivalent of one-fifth of the total fresh water runoff of the United States for cooling.

Both fresh and saline water are used for



PROJECTED ELECTRIC GENERATION 1965-2020



LOCATION OF NUCLEAR POWER PLANTS

cooling; in some cases, sewage effluents are used. Water for condenser use may be withdrawn from rivers, lakes, reservoirs, canals, tidewater, or groundwater. When adequate water supplies are available and allowable discharge temperatures permit, the water is usually passed through the condensers once and returned to the source body of water. The economic desirability of once through cooling has traditionally been a factor in locating power plants. Sites have usually been selected where large quantities of water were available for cooling at all times. Such sites in inland areas, however, are limited in number, and the increasing density of power plants on rivers and estuaries will require utilities to find effective means of controlling thermal discharges. Two factors can limit the adverse environmental effects of new power plants: better selection of sites and improved design of plants and equipment to reduce the discharge of heated wastewaters.

With the tremendous pollution potential of projected power production, it is exceedingly fortunate that waste heat from power generation is amenable to treatment or control at a reasonable cost. The amount of waste heat discharged to waterways can be reduced by improving the efficiency of the thermal plants, by making productive use of heat, or by using cooling towers, cooling ponds or spray ponds. The impact of thermal pollution control on the consumer cost of electricity is relatively minor.

The selection of appropriate sites for locating power plants so as to minimize environmental damage poses a significant challenge to both the industry and government. Environmental concerns will necessitate the consideration of many more factors in the planning of power production facilities than has been the practice in the past. In addition to thermal pollution control, a number of other critical selection factors make siting very complicated—aesthetic impact, availability of water supply, safety (for example, potential of earthquakes), air pollution control, access to transportation and others. These factors compete in some ways, and the tendency in the past was to give primary attention to producing power at low cost to the consumer rather than to environmental considerations. Installation of facilities, such as long discharge lines or cooling towers to control thermal pollution will affect cost factors and require more space for the plant and may make it more difficult to meet aesthetic goals. The increasing use of nuclear power adds another potential hazard to the environment—radiation. Siting is likely to become an increasingly difficult and controversial factor in the continued growth of power production.

Oil and Hazardous Substances

Dumping and accidental spilling of oil and other hazardous materials continue to increase each year and constitute major pollution threats to the water resources of the Nation. Pollution by oil and other hazardous substances may occur in any of our waterways and coastal areas, or on the high seas as a result of deliberate dumping, accidental spills, leaks in pipelines, drilling rigs and storage facilities, or the breakup of transportation equipment.

Damages caused by oil pollution are both significant and diverse. Such pollution can destroy or limit marine life, ruin wildlife habitat, kill birds, limit or destroy the recreational value of beach areas, contaminate water supplies, and create fire hazards. Damages caused by other hazardous substances can be just as significant and diverse as those caused by oil pollution. The sheer volume of oil transported or used, however, makes oil the largest single source of pollution of this type.

The majority of oil spills exceeding 100 barrels involve discharge from vessels. Approximately one-third of the incidents involve pipelines, oil terminals, bulk storage facilities, etc.

Reported Oil Spills in U.S. Waters
(Over 100 barrels)

	1968	1969
Vessels	347	532
Shore facilities	295	331
Unidentified	72	144
Total	714	1007

Oil pollution may come from several different sources. Gasoline service stations dispose annually of 350 million gallons of used oil. Two hundred thousand miles of pipelines carry more than a billion tons of oil and hazardous substances. The pipelines cross waterways and reservoirs and are subject to cracks, punctures, corrosion, and other causes of leakage. Offshore oil and gas exploration and production occur mainly in the Gulf of Mexico, Southern California coastal waters, Cook Inlet in Alaska, the Great Lakes, and the East Coast. The blowout of wells, the dumping of drilling muds and oil-soaked wastes, and the demolition of offshore drilling rigs by storms and vessel collisions are significant potential pollution sources. In 1969 a massive oil spill occurred off Santa Barbara, California, with severe damage to the coastline, waterfowl and beaches. More recently a fire and subsequent oil blowout on an offshore production well in the Louisiana Gulf presented a serious threat to our marine environment.

Vessel casualties, too, are a prime source of oil pollution, and the damage can be extensive when several million gallons of oil enter the water at one time. The largest spill to date was over 30 million gallons in 1967 from the TORREY CANYON. England, alone, spent $8 million on clean-up following this casualty. In Tampa Bay on February 13, 1970, the tanker DELIAN APOLLON ran aground and spilled over ten thousand gallons of fuel oil into the bay, and some 100 square miles of area were contaminated as a result. Discharge of either oily ballast water or "slop oil" recently occurred offshore of Alaska, causing extensive

Birds suffered most from the more than 200,000 gallons of crude oil that escaped from this ruptured Santa Barbara well.

waterfowl mortalities and contamination of fur seals and sea lions.

Hazardous substances can enter our waters in many of the same ways as oil. Spills caused by accidents or ruptures of containers are important sources. For example, a train wreck on January 2, 1968, at Dunreith, Indiana, spilled a cyanide compound into Bucks Creek, a tributary of the Big Blue River. The cyanide moved with the flow of the stream and an estimated 1,600 pounds passed the town of Carthage on the Big Blue River, downstream from the site of the accident. The cyanide caused fish kills in the affected streams; more than 25 cattle were reported killed; at least one industrial plant temporarily ceased operations; and groundwater supplies were contaminated.

Incidents similar to the cyanide spill are not uncommon and can cause serious consequences in the affected areas. Presently, an estimated 10,000 spills of oil and hazardous materials occur annually in the navigable waters of the Nation. With the increasing volumes of these materials being transported, the number of spills may grow. Some increase in the number of spills reported can be expected since discovery and notification systems are improved continually and spills, that heretofore have gone unreported, will now be recorded. Unfortunately, the potential magnitude of each individual spill will increase as the size of the carrier increases. For instance, the UNIVERSE IRELAND, a ship launched in August, 1968, has a cargo capacity of over 90 million gallons of oil. The construction of even larger ships is under consideration. The potential pollution from a ship of that capacity is about three times greater than that resulting from the TORREY CANYON spill.

Mine Drainage

Mine drainage, one of the most significant causes of water quality degradation and destruction of water uses in Appalachia and the Ohio Basin States, as well as in some other mining areas of the United States, degrades water primarily by chemical pollution and sedimentation. Acid formation occurs when water and air react with the sulfur-bearing minerals in the mines or refuse piles to form sulfuric acid and iron compounds. The acid and iron compounds then drain into ponds and streams. About 60 percent of the mine drainage pollution problem is caused by mines which have been worked and then abandoned. Coal mines idle for 30 to 50 years may still discharge large quantities of acid waters.

Although acid pollution is usually limited to coal field areas, suspended solids and sedimentation damage can extend much further downstream. Mine drainage pollution may degrade municipal and industrial water supplies; reduce recreational uses of waters; lower the aesthetic quality of waterbodies and corrode boats, piers and other structures. During 1967, over a million fish were reported killed by mine discharges, ranking mine drainage as one of the primary causes of fish kills in the United States.

Total unneutralized acid drainage from both active and unused coal mines in the United States is estimated to amount to over 4 million tons of sulfuric acid equivalent annually. Although about twice this amount of acid is actually produced, roughly one-half is neutralized by natural alkalinity in mines and streams. In Appalachia alone, where an estimated 75 percent of the coal mine drainage problem occurs, approximately 10,500 miles of streams are reduced below desirable levels of quality by acid mine drainage. About 6,700 miles of these streams are continuously degraded; the remainder are degraded some of the time. Acid mine drainage problems also occur from other types of mining throughout the Nation, such as phosphate, sand and gravel, clay, iron, gold, copper and aluminum mines.

It is estimated that 3.2 million acres of land in the United States had been disturbed by surface (strip and auger) mine operations prior to January 1, 1965. Of these 3.2 million acres, approximately 2 million acres are either unreclaimed or only partially reclaimed. An additional 153,000 acres have since been disturbed each year, only part of which are reclaimed annually. In addition to contributing to the acid pollution problem, surface mines also contribute large quantities of sediment to the Nation's streams.

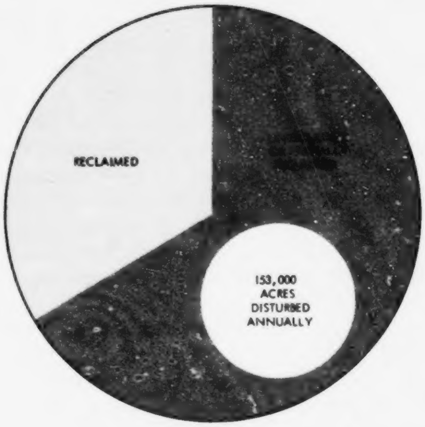
Sediment yields from strip-mined areas average nearly 30,000 tons per square mile annually—10 to 60 times the amount of sedimentation from agricultural lands. At this rate, the 2 million acres of strip-mined land in need of reclamation could be the source of 94 million tons of sediment a year.

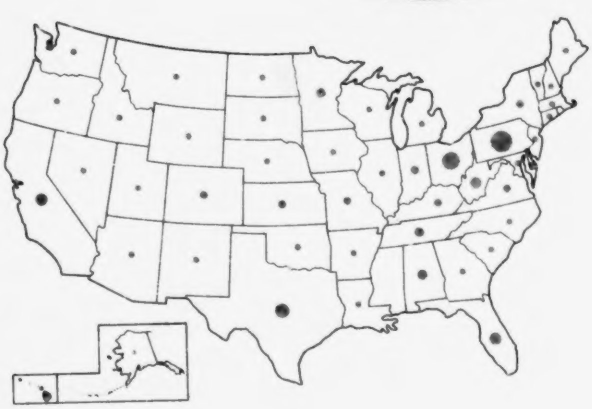
In addition to mine drainage, refuse piles, tailings ponds and washery preparation residues are also important indirect sources of pollution from mining. For many minerals, such as phosphate, the pollution from processing operations exceeds that resulting directly from the mining operation. The pollution from coal mines in Indiana and Illinois, for example, stems primarily from refuse piles, tailings ponds and preparation plants. No national estimates are available, however, which show the volume or relative importance of pollution from these sources.

Prevention of acid and sediment drainage from surface mines can be accomplished through renovation of the mined area. Regrading and revegetation can be very effective means of mine drainage control, and reclaimed mining areas can be used for recreation and other beneficial uses. Other methods of control may involve sealing mines, diversion and/or control of underground drainage and use of chemicals or biological inhibitors to reduce the formation of acid. Neutralization is the most common method of treating acid drainage.

Although many methods have been applied and others are being tested, the problems of mine drainage have been very difficult to deal with, largely because of the costs involved in achieving significant levels of control. Recent cost estimates for pollution control and land reclamation in the mining States total as much as $7 billion. Moreover, the distribution of the mine pollution problem is such that a large percentage of this investment would have to be made in some of the most economically depressed areas in the Nation, involving mines that are no longer operating or producing any revenues.

ACREAGE DISTURBED BY SURFACE MINING





Sedimentation and Erosion

Sediments produced by erosion are the most extensive pollutants of surface waters. It is estimated that suspended solids loadings reaching our waters are at least 700 times the loadings from sewage discharge. The dirty brown or gray appearance of a river or reservoir after a rainstorm is due to sediments washed in from croplands, unprotected forest soils, overgrazed pastures or the bulldozed "developments" of urban areas. The presence of sediment generally increases the cost of water purification and reduces the value of water recreation, and nutrients adsorbed on sediment particles contribute to undersirable conditions in lakes.

Sediments adversely affect commercial and game fish habitats, power turbines, pumping equipment and irrigation distribution systems. Deposited during floods, sediments damage crops and, if coarse-textured, may reduce the productivity of the soil. Channels and drainage facilities may be impaired, and the clean-up and removal of sediments from residential and other developed areas is costly. Sediments are also depleting the capacity of artifical reservoirs in this country, and potential storage sites to replace these depleted reservoirs are limited.

Erosion rates of lands are increased 4 to 9 times by agricultural development, and may be increased as many as 100 times by construction activities. Paving and drainage facilitate flushing of urban areas. The 470,000 miles of rural and secondary roads in the United States also contribute significantly to sediment pollution. Erosion is a serious problem on at least 300,000 miles of the Nation's stream banks and along many of the 470,000 miles of rural and secondary roads. As has been discussed, sedimentation from stripped mining lands is also considerable.

Construction is a large contributor to the sedimentation problem if erosion control is not provided. According to the 1969 report, *The Cost of Clean Water and Its Economic Impact,* the average sediment yield during a rainstorm at highway construction sites is about 10 times greater than that for cultivated land, 200 times greater than for grass areas, and 2000 times greater than for forest areas, depending upon the rainfall, land slope and the exposure of the bank. Similar rates of sediment production occur from commercial and industrial construction in urban areas. The Potomac River Basin discharges about 2.5 million tons of sediment a year into the Potomac estuary, a large share due to disturbance of land surfaces by construction in urban areas.

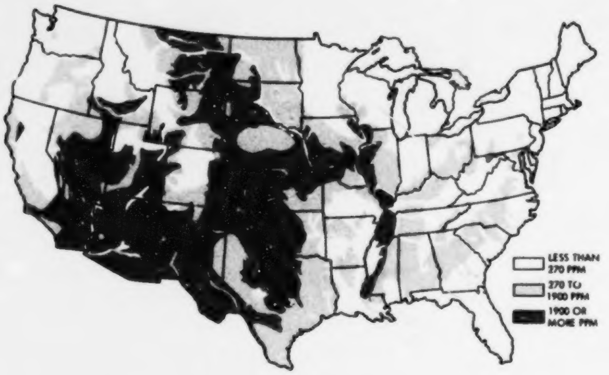
Sources of sediment are diffuse and therefore often difficult or costly to control. Where feasible, erosion prevention provides the most effective method for sediment control. In certain remote arid areas of United States, however, such measures would be extremely expensive, and on certain construction sites, completely impractical.

With regard to agricultural land, erosion control by such means as contour cultivation or crop rotation may achieve many benefits—reduction of sediment pollution of streams and damage to water uses, and conservation of productive soil and vegetation resources. Gully erosion may require costly measures of filling, seeding or damming.

Excessive sediment runoff from highway construction can be controlled by reducing the amount of time ground is exposed and/or using measures such as grassing or channeling to prevent sediment from reaching streams. Similar control measures can be used to prevent erosion at other types of construction sites.

Erosion control practices may add about $1000 to the cost of each mile of new highway and $1000 per highway construction project for overhead. For the 470,000 miles of secondary and rural roads which need erosion control measures, costs may range from $275 up to $15,000 per mile, with an additional $50 per mile per year required for maintenance. In total, the initial costs to control erosion from roads may range from $130 million to $7 billion, with annual maintenance thereafter costing $23 million. Much of the construction costs and all the maintenance costs would be non-Federal.

Control of erosion at urban construction projects could cost from $100 to $1000 per project depending on size and location. Thus preventing water pollution from construction activities may add somewhat to the cost of buying a house.

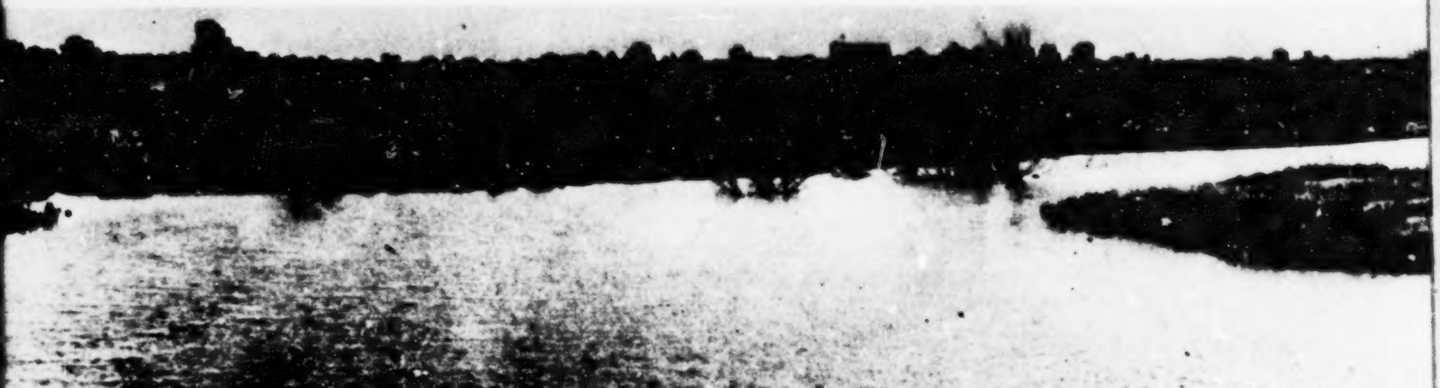


CONCENTRATION OF SEDIMENT IN STREAMS

Control of streambank and streambed erosion may require construction of special stabilization structures, riprap of streambanks and sloping and vegetating eroded banks. These measures, however, may not be compatible with other water uses. Estimates of the cost of renovating the eroded streambanks in the United States range from $200 million to $3 billion.

In summary, the sources of water pollution from sedimentation are exceedingly diverse and diffuse. Much can be done to reduce this cause of pollution, but control and prevention will be very costly.

Erosion control reduces sediment pollution. Here an eroded gully has been transformed into a productive farm pond.



Feedlot Pollution

Both the increasing number of animals raised and the modern methods of raising these animals contribute to the increased pollution of waters from animal wastes. Beef cattle, poultry and swine feeding operations, along with dairy farms, are the major sources of actual or potential water pollution from animal wastes.

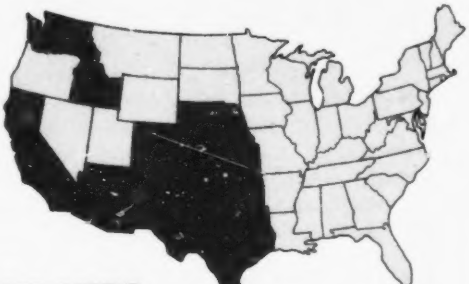
In the past two decades production of animal products has been increasing rapidly. The technology of this increasing production requires that animals be confined in a minimum space and fed a concentrated ration, both of which increase the pollution potential of animal wastes. The heavy concentration of wastes precludes their natural decomposition and assimilation on pastures as is the case where animals are more dispersed. The heavy concentration also makes it difficult to find nearby farmland that can use manure as an economical source of fertilizer. In addition to being heavily concentrated in small areas, wastes from concentrated feeding operations have a high oxygen demand when they are being degraded, and they may contain a high proportion of roughages.

When animal wastes find their way into water, they can contribute to pollution in several ways. Heavy concentrations of animal wastes in water may: add excessive nutrients that unbalance natural ecological systems, causing excessive aquatic plant growth and fish kills; load water filtration systems with solids, complicating water treatment; cause undersirable tastes and odors in waters; add chemicals that are detrimental to both man and animals; increase consumption of dissolved oxygen, producing stress on aquatic populations and occasionally resulting in septic conditions; and add microorganisms that are pathogenic to animals and to man.

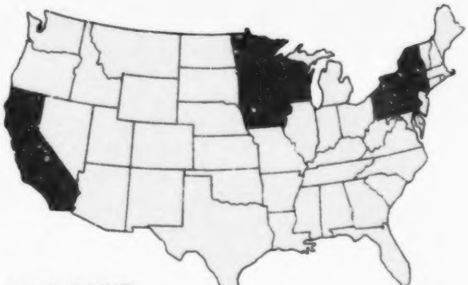
The magnitude of the livestock pollution problem is primarily dependent upon the number of animals that are needed to meet the demand for their products. The average population increase in the United States is about 2.5 million people per year. At 1966 consumption rates, each additional million people will require another 172,000 beef cattle, 24,500 dairy cattle and 433,000 hogs. Thus, it can be seen that if these consumption rates continue, the amount of animal wastes will continue to increase significantly. In addition, the trend toward increased use of confined feeding and concentrated rations will continue to add to the pollution potential of the animal wastes.

Agricultural waste sources are scattered across the country, with large amounts of cattle being produced in the Midwest, West and

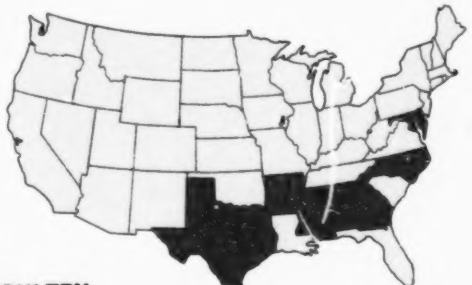
CONCENTRATION OF WASTE PRODUCING FARM ANIMALS



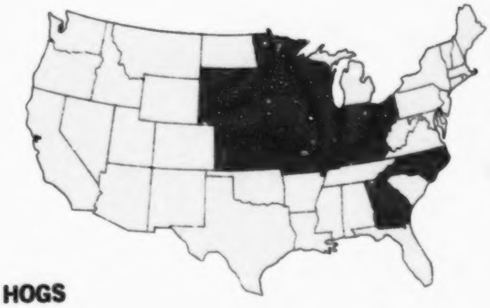
BEEF CATTLE



DAIRY COWS



POULTRY



HOGS

Southeast; poultry in the South and some of the Middle Atlantic States; and hogs in the Midwest and South. Although there have been few detailed assessments of the distribution of agricultural waste problems, feedlot pollution appears to be a particularly severe water pollution problem in certain parts of the States where large cattle feedlots are located.

A number of waste handling and control methods are available, which vary widely in complexity and cost. Many States are just beginning to survey feedlot operations and other agricultural operations to determine the pollution potential and necessary measures to deal with the problem.

Other Agricultural Wastes

Other pollution problems are caused by farming operations, in addition to those related to erosion and animal wastes which have been discussed. There is increasing concern about the short-and long-term environmental effects of runoff from farmlands which contains a variety of chemicals including pesticides, herbicides, insecticides and fertilizers. The soil conservation methods discussed earlier in relation to sediment control also help to control runoff. A number of Federal agencies are cooperating on research devoted to the search for chemicals, or biological control methods, which will sustain agricultural productivity while reducing the possibility of environmental damage and destruction of aquatic life and wildlife.

In some areas, serious water quality degradation has occurred as a result of runoff from irrigated lands. Water returned from irrigated areas usually has a much higher concentration of dissolved solids than does streamflow, because the diverted water leaches additional solids from the canals and fields, and because evaporation from the soil and transpiration by the crops concentrates these dissolved solids into a smaller flow of water. Thus, as the concentration of dissolved solids in surface water increases with each irrigation diversion and drainage return, the quality of the water deteriorates and its suitability for further irrigation diversion or other beneficial uses is impaired. This degradation of water quality is evident in many of the river basins where irrigation is practiced and must be taken into account in consideration of any further development.

Particular problems have been encountered in the Colorado River Basin. While agricultural productivity in parts of the Basin has been impressive as a result of irrigation, the Colorado River is becoming more saline every year. Its agricultural usefulness in parts of the lower basin has been seriously impaired.

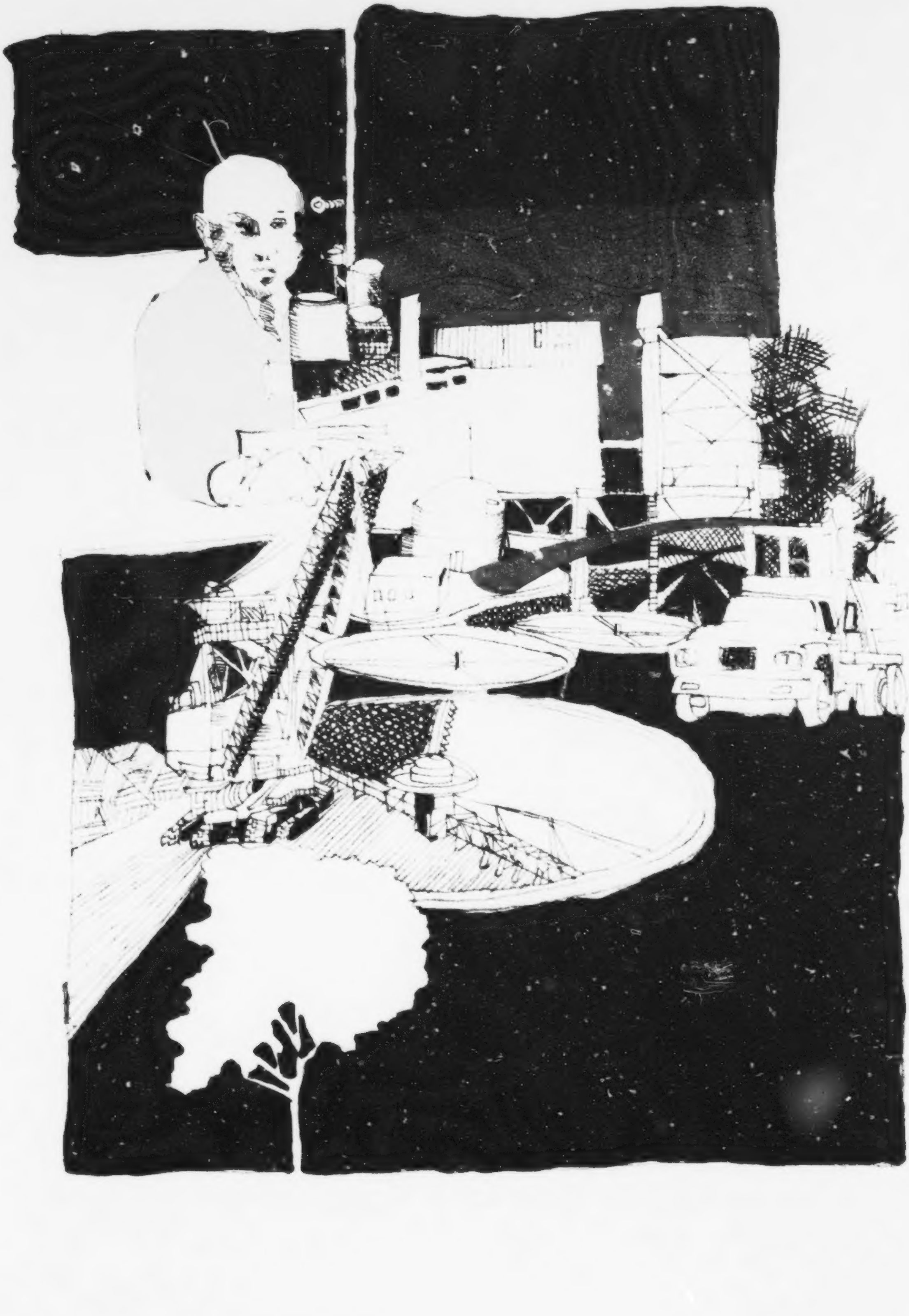
Some methods to control leaching by irrigation, such as lining canals, are available, and in some areas the possibility of using desalination plants is being studied. Overall, however, the water quality problems caused by irrigation return flows are difficult and expensive to control. Degradation by agricultural practices of the water resource on which that agricultural development depends may place previously unconsidered limitations on the extent to which further massive irrigation schemes are practicable.

Wastes from Watercraft

The problems of water pollution incidents, often spectacular, caused by vessel accidents which release oil or other hazardous materials has been discussed. But vessels (and marinas) also contribute to pollution of the Nation's waters in a number of other ways. It has been determined that approximately 46,000 Federally registered commercial vessels, 65,000 unregistered commercial fishing vessels, 1600 Federally owned vessels and 8 million recreational watercraft use the navigable waters of the United States. The potential pollution from sewage from these vessels is estimated to be equivalent to just over 500,000 persons, comparable to a city the size of San Diego. In major harbors such as the Hamptom Roads, Virginia area, sewage discharges from vessels contribute significantly to water pollution, damaging shellfish harvesting and recreation.

At the present time, a very small percentage of watercraft are equipped with sewage treatment devices. Sewage equipment for use aboard watercraft is available in the form of holding tanks which collect sewage for disposal onshore, incinerators and biological treatment facilities. Estimates of the costs to install control devices on vessels to prevent sewage pollution come to about $660 million.

Other significant pollution from vessels is often evident where ships discharge bilge and ballast water containing oils and a variety of other substances. Poor "housekeeping" practices may cause a good deal of environmental degradation. Even if vessels go beyond the territorial waters to discharge bilge and ballast and solid wastes in the open ocean, aesthetic and other damages often result, as witnessed by Thor Heyerdahl and his crew aboard the RA.



A WATER POLLUTION CONTROL PROGRAM FOR THE 1970'S

Water pollution control has traditionally been a multi-agency, multi-program effort with the localities and industries having the principal responsibility for installing and operating pollution control facilities; the State water pollution control agencies having the basic regulatory programs; and the Federal government backing up the localities with treatment facility grants and backing up the States with additional enforcement authority, technical, financial and planning assistance, training and research and development. These basic arrangements have provided for a valuable division of effort and responsibility to build on and strengthen for the future. In looking to the future, it is necessary to keep in mind this wide basic underpinning of pollution programs and intergovernmental relations that has been established over the years. These ongoing activities, which will be fully described in this report, provide the basis and the background for the areas of acceleration—those major program thrusts—which are now necessary to meet the challenge of the 1970's.

These major program thrusts are aimed at immediate implementation of the technology available today to substantially reduce municipal and industrial pollution over the next few years. While research and technical studies must continue on methods of dealing with other complex pollution problems, immediate emphasis must be given to the regulatory and financial assistance programs needed to abate urgent municipal and industrial problems without further delay. Thus, far-reaching proposals to strengthen both of these basic programs within the context of the existing Federal-State-local partnership represent the keystone of the Nixon Administration's water pollution control program.

Better Financing of Municipal Treatment

The proposed legislative program for the 1970's calls for strengthening the present construction grants program with a major new investment in municipal waste treatment facilities, providing a strong and guaranteed program of Federal waste treatment works construction grants. Economic estimates by the Federal Water Quality Administration (FWQA), have pointed to a need for at least $10 billion worth of investment in municipal facilities to achieve the treatment goals contained in the water quality standards all across the Nation. The proposed Federal share would be $4 billion—$1 billion over each of the next four years. The States would be encouraged to share the total cost of projects with the Federal government and the localities in the present grant program, through continuation of the incentives that allow projects to receive a larger Federal share if the States contribute funds, and through new provisions in the proposed formula for allocating funds.

In addition to providing for more Federal funds for waste treatment works construction, the proposals would also strengthen the capacity of the construction grants program to assure that facilities are built according to the best designs and in accordance with basin and regional planning requirements. The formula for allocating grant funds would be revised to permit more funds to be spent for plant construction in areas where the need is greatest and where the greatest improvements in water quality will be realized.

The Secretary of the Interior has recently published proposed regulations in the Federal Register, which will help assure that the treatment plants constructed with Federal assistance will be well-built and well-maintained through more stringent requirements for design, operation and maintenance. Moreover, the regulations will require comprehensive river basin programs that would relate construction of treatment facilities to the magnitude and types of other pollution problems. In other words, the aim would be to assure that municipal treatment plants are built in areas where there is a positive program to clean up other kinds of water pollution. In line with this kind of comprehensive approach, the grants program would encourage development of regional treatment facilities that handle municipal and other wastes on an area-wide basis and which provide for treatment of many kinds of industrial wastes, as well as municipal sewage.

Better Standards and Enforcement Authority

One of the chief mechanisms for achieving an accelerated pollution abatement program is effective use of regulatory powers. The Federal government has had an enforcement program since 1956; its accomplishments will be discussed in this report. The present authority, however, is limited, and the procedures under present law are time-consuming. Although Federal-State water quality standards have been set which contain abatement requirements for all municipal and industrial waste sources on interstate waters, the Federal government does not have jurisdiction to enforce standards without the permission of the Governor if pollution occurs in only one State.

Legislation has been proposed to apply the regulatory provisions of the Federal Water Pollution Control Act expressly to boundary waters, as well as to interstate and navigable waters, the tributaries of these waters, ground-waters, the waters of the Contiguous Zone and, under certain circumstances, the high seas. Water quality standards, which now consist of water quality criteria and a plan for their implementation and enforcement, would include a third element: water quality requirements controlling discharges, or effluent requirements. The abatement authority would be made directly applicable to discharges which violate water quality standards in any or all of their three elements. A Governor's consent would no longer be required in cases of intrastate standards violations, nor in cases of enforcement conferences and postconference court action involving intrastate pollution. The court could impose a penalty on violators in both types of actions of up to $10,000 a day, and the second stage in the present three-stage enforcement process, the public hearing, would be eliminated. In addition, the Secretary of the Interior could seek an immediate injunction in an emergency situation in which there is an imminent and substantial danger to the health or welfare of persons or possible irreparable damage to water quality or the environment. The Administration's proposal would also provide other new enforcement tools.

The proposed legislation is not meant to override the responsibility of the State agencies to enforce pollution control regulations; rather, it is intended to provide a backstop to the States' authorities. The Federal government will continue to encourage the States to carry out their responsibilities by providing better financial and technical assistance to the States, in addition to the promise of Federal involvement when the States fail to act.

Better Assistance To The States

The challenge of carrying out an accelerated pollution control program and implementing water quality standards has placed increased responsibilities for monitoring, enforcement and technical activities on the States, as well as on the Federal government. The responsibilities of the States will further be increased by the recently enacted legislation which requires State certification of Federally-licensed activities; and acceleration of waste treatment works construction will place yet another heavy burden on State pollution control agencies.

For some years, the Federal government has assisted in supporting the administrative expenses of the State and interstate water pollution control programs through program grants, which are now at a $10 million level. To aid the States in expanding their programs, the proposed legislation would increase the authorization for State program grants each year on a sliding scale from $12.5 million in FY 1971 up to $30 million in FY 1975. Emphasis for using the augmented grant funds would be placed on certain program improvements, such as establishing effective waste discharge permit systems, improving sewage treatment facilities programs, and setting up programs for training and developing water pollution control personnel.

Besides providing financial assistance, the Federal government will continue to help the States through joint water quality monitoring activities, technical support and training programs for State personnel.

Better Programs For Prevention and Abatement Of Pollution From Federal Facilities

One of the primary tasks of the Federal government in pollution control is to assure that the facilities owned by the government and activities carried out or licensed by the government do not contribute to water or air pollution. In a move to strengthen the Federal commitment to pollution control, President Nixon issued a new Executive Order on pollution control from Federal facilities on February 4, 1970. This Order requires that all projects or installations owned or leased by the Federal government be designed, operated and maintained in conformance with present and future water quality standards. The Executive Order provides for strict compliance and establishes a deadline by which existing facilities must comply with environmental standards. This comprehensive plan for pollution abatement includes control, not only of water pollution, but also of air pollution by Federal facilities.

In a subsequent Executive Order issued on March 7, implementing the landmark National Environmental Policy Act of 1969, the President set forth additional procedures to assure that Federal programs will meet national environmental goals. He directed that attention be given to Federal policies, including administration of loans, grants, contracts, and licenses, to minimize their pollution impact.

Enactment by the Congress of the Water Quality Improvement Act of 1970 adds further force to this effort by requiring that applicants for Federal permits, for activities such as construction of nuclear facilities or reservoirs, meet applicable water quality standards.

Programs To Deal With Emerging Problems

At the same time that a massive effort to employ present technology to clean up municipal and industrial water pollution is being initiated, the water pollution control program for the 1970's looks to expanding its capacity to deal with other complex pollution problems. One of the most significant emerging programs is in oil pollution control, where substantial expansion of Federal prevention, control and enforcement activities is called for under the 1970 Act. In conjunction with development of plans to prevent and control oil spills, planning has been undertaken to handle accidents of other hazardous substances.

Increased attention has been given to methods of preventing and controlling pollution caused by vessels. The Water Quality Improvement Act provides for Federal performance standards for water pollution control equipment on commercial and private vessels.

With the greatly increased growth of electric power producing facilities, thermal pollution control has emerged as a major pollution problem. The water pollution program for 1970's anticipates much more stringent controls on the discharge of heated effluents, a greater research effort to improve thermal standards and abatement technology, and an active participation in planning studies to locate power facilities in areas where environmental damage would be minimized.

Another problem which is becoming increasingly significant is that of pollution caused by persistent pesticides. Under the 1970 Act, the FWQA will be developing, within the next two years, the scientific knowledge necessary for the development of water quality criteria for pesticides. This will require increased research on the effects of pesticides and the search for less harmful pesticides, expanded monitoring and investigation to identify critical areas and closer interagency coordination with the Departments of Agriculture and Health, Education and Welfare to assure full utilization of regulatory authorities to achieve environmental protection.

The expanded use of deep-well and other subsurface waste disposal practices poses a new challenge, particularly for protecting the purity of groundwater supplies. Meeting this challenge will require increased research on groundwater quality and movement and on the effects of wastes, investigations of present disposal sites and tighter regulation of subsurface waste disposal practices.

The activities and problems just described will receive increasing emphasis in the coming months. How these areas fit into the full water pollution control program will be described in greater detail below. As noted at the beginning of this section, the financial assistance and regulatory programs must rest upon a broad base of planning and research, technical studies, manpower development and other programs. It must also be clear that the Federal program is but one aspect of a nationwide network of State, local and, increasingly, regional activities. The greatest challenge of the 1970's may well be intergrating these programs to form a comprehensive nationwide attack on pollution of our environment.

PROGRAMS FOR POLLUTION WATER CONTROL

REGULATORY PROGRAMS

Strong, effective, and equitable regulatory activity is the most essential element in the nationwide pollution control effort. President Nixon in his environmental message has declared that "strict standards and strict enforcement are necessary—not only to assure compliance, but also in fairness to those who have voluntarily assumed the often costly burden while their competitors have not." Such effective nationwide enforcement requires a complementary State-Federal regulatory effort.

From the initiation of the Federal water pollution control program, the Congress has recognized the basic role of the States in implementing and enforcing water pollution control regulations. The Federal Act, however, asserts broad jurisdiction for the application of Federal regulatory authority to back up the States and to assure effective pollution control. Over the years, this Federal regulatory role has been expanded and strengthened to include: water pollution enforcement authority on interstate and, under certain circumstances, navigable waters; authority to establish and enforce water quality standards on interstate waters; and administration of the Oil Pollution Act of 1924. In addition, there has been a growing emphasis on control of pollution from Federal facilities.

Through its role in administering or participating in these programs, the Federal Water Quality Administration (FWQA) has emerged as the principal water pollution regulatory agency in the Federal government. Recently enacted and proposed legislative changes will further strengthen FWQA's regulatory authority. Passage of the Water Quality Improvement Act of 1970 adds significantly to Federal authority to control vessel and oil pollution and to requirements for control of water pollution from Federally licensed activities. Equally significant, the Administration's legislative proposal would result in far-reaching improvements designed to provide a comprehensive, swift and equitable regulatory authority. These measures will vastly strengthen the Federal government's capacity to control water pollution.

Water Quality Standards and Enforcement

Federal enforcement authority on interstate and navigable waters has been strengthened over the years since initial enactment of the Federal Water Pollution Control Act in 1956. The most significant increase in these authorities stemmed from the Water Quality Act of

1965, authorizing the establishment and enforcement of water quality standards for interstate waters, including coastal waters.

Today, action to abate pollution of interstate or navigable waters which endangers the health or welfare of persons may be taken at State request or on Federal initiative. The Governor's request is required in cases of intrastate pollution of such waters. However, action may be taken on Federal initiative to abate pollution, whether inter- or intrastate, of such waters which impairs the marketing in interstate commerce of shellfish or shellfish products. Action to abate international pollution may be taken under certain circumstances.

Two abatement procedures are provided in the Act. A three-stage enforcement procedure is set out in the law—conference, public hearing, court action—the succeeding stage to be reached only if adequate progress is not made at the previous stage. In a case of violation of water quality standards, direct court action may be sought 180 days from the date of notification of violation: the 180-day period is to be used for obtaining voluntary compliance if at all possible.

The water quality standards authorized by the 1965 legislation are the keystone of America's clean water program. The Act called upon the States to establish standards for their interstate waters. These State standards could then be accepted as Federal standards by the Secretary of the Interior. To set standards, the States had to make crucial decisions involving the desired uses of their water resources, the quality of water to support these uses and specific plans for achieving such levels of quality. The standards are, in effect, blueprints for the national program.

ENFORCEMENT
CONFERENCE

Water quality standards are composed of two parts: the criteria designed to protect present and future water uses of interstate waters through establishment of quality levels which must be maintained, and a plan of implementation which outlines the pollution abatement measures which will be required to meet those criteria. First responsibility for implementing and enforcing water quality standards rests with the States. But, once accepted by the Secretary of the Interior, the standards become Federal standards and are subject, if necessary, to Federal enforcement. In the absence of timely and acceptable action by a State to adopt water quality standards on interstate streams, the Secretary of the Interior can initiate action to establish Federal standards.

The standards of all of the States have now been approved by the Secretary of the Interior. With the establishment of these standards, there is for the first time a specified set of conditions for the enhancement and protection of the water quality of interstate waters throughout the country to which waste dischargers must adhere. The goal of providing nationwide, systematic and comprehensive water quality standards, however, which are tailored to the particular use and quality of the specific waters, is far from being accomplished.

The Secretary excepted from initial approval portions of the standards of over half the States, where certain aspects of the standards were not stringent enough to assure adequate water quality protection. For example, the temperature criteria of a number of States have been excepted, because they did not provide adequate safeguards against thermal pollution. In other cases, implementation plans have not received approval because the abatement measures required or schedules established were deemed inadequate.

During the past year, heavy emphasis has been placed on resolving these exceptions so that State standards can be fully approved. Negotiations have been underway with the States concerned and a number of States have agreed to improve their standards. In two instances, where such agreement could not be reached, the Secretary has taken initial action toward direct establishment of Federal standards, under procedures specified by the Act. A conference to consider the establishment of water quality standards for certain interstate waters of Iowa convened at Davenport on April 8 and at Council Bluffs on April 15, 1969. Regulations setting forth the Federal standards have been published in the Federal Register and will be adopted if the State does not adopt acceptable standards within the specified time period. A conference to consider the establishment of water quality standards for Virginia's interstate waters was called for December 9–11, 1969, and subsequently postponed when the State Water Control Board indicated it would act on the Secretary's recommendations. During the year ahead, a principal objective will be elimination of the exceptions from the standards of all the States, by agreement or direct Federal action.

Even where standards have been approved, there is a need to refine and improve certain of the water quality criteria to assure that the criteria applied will adequately protect the intended water uses. Continued emphasis must be given to improving our knowledge of water quality characteristics and requirements and incorporating this information in approved criteria.

Towards this end, FWQA, the Atomic Energy Commission and the Department of Health, Education and Welfare are working together to develop standard radiological criteria for natural waters. The radiological criteria currently established in water quality standards possess certain shortcomings insofar as providing complete coverage of all radioactive pollutants and maximum protection for all water uses. These established criteria do provide reasonably adequate protection from the sources of radiological wastes currently in place, but with the expected growth of the nuclear power industry, the nuclear fuel reprocessing industry and other peaceful uses of nuclear materials, such as those being developed through Operation Plowshare, much more precise and restrictive criteria for water will be required. The radiological criteria being developed are aimed at this objective. Also, they will complement the radiological effluent and emission standards presently set by the Atomic Energy Commission for nuclear power plants and other users of nuclear materials.

Stricter control of pesticides will be needed to protect wildlife.

The increasing impact of pesticides on the environment has pointed to the need for both stricter regulation of pesticide uses and the establishment of specific, quantified pesticide criteria for natural waters. Under the Federal Insecticide, Fungicide and Rodenticide Act, the authority to regulate the uses and labeling of pesticides resides with the Secretary of Agriculture. An interdepartmental agreement has recently been established among the Departments of Agriculture, Interior and Health, Education and Welfare through which environmental, fish and wildlife, and public health interests in pesticide uses are factored into the Department of Agriculture's registrations. With respect to pesticide criteria for interstate waters, this responsibility and authority rests with the Secretary of the Interior under the Federal Water Pollution Control Act.

General criteria on all toxic materials have been incorporated in all of the water quality standards adopted and approved pursuant to the Act; however, specific quantified criteria for the various pesticides in current use have not been made a part of these standards. Under a provision of the Water Quality Improvement Act of 1970, FWQA will be developing specific and quantified information on pesticides to be subsequently incorporated into water quality standards.

Most important, a vigorous State and Federal enforcement program is needed to obtain compliance with water quality standards and to assure that treatment schedules are being met. Development of strengthened and accelerated enforcement efforts has been a major objective during the past year. Where the States are prepared to exercise their authorities, FWQA stands ready to provide any assistance they may require. A number of States are moving aggressively against polluters. Illinois has not hesitated to initiate proceedings against the very giants of industry. Pennsylvania successfully carried through on the first test of its Clean Stream Law. And, with the passage of the Porter-Cologne Water Quality Act in 1969, California has vastly strengthened and stepped up its regulatory activity.

At the Federal level, the record of enforcement activity compiled under the new Administration reflects a commitment to a vigorous enforcement program equally and fairly applied.

In this same year, FWQA initiated the first enforcement actions to abate violations of water quality standards under procedures provided by the Water Quality Act of 1965. As mentioned before, the procedure provided in the law is direct court action, preceded by a 180-day notice to the alleged violator. On August 30, 1969, the Secretary issued such 180-day notices to six alleged violators. The first involved the Eagle-Picher Industries, Inc., whose mining operations resulted in discharges violating water quality standards established for Spring River in Kansas and Oklahoma. The other five actions were taken to abate violations of Lake Erie water quality standards and involved the City of Toledo and Interlake Steel on the Maumee River and Republic Steel Co., U.S. Steel, and Jones and Laughlin on the Cuyahoga River. Hearings were held with all six of the alleged violators. All six sources have indicated that they will comply.

FWQA's enforcement conference activity under previously established procedures has also been stepped up. The initiation of the Biscayne Bay conference in February, 1970, brought to 50 the total of such actions taken since 1956. Five of these—Lake Superior, Escambia River Basin, Perdido Bay, Mobile Bay, and Biscayne Bay—have been held since January 1, 1969. In addition, eight conferences were reconvened and three progress meetings held to put renewed emphasis on progress in obtaining compliance.

The enforcement conference has been an effective mechanism for the solution of complex and long-standing pollution situations. At the recently reconvened Potomac River conference, for example, agreement was reached on cooperative programs of remedial action which include the most stringent waste treatment requirements yet fixed for a metropolitan area. The Lake Michigan conference, reconvened in 1969 and again in March, 1970, has dealt with control of the more diffuse wastes, such as nutrients, thermal pollution, and agricultural wastes.

More recently, in February, 1970, a Federal-State enforcement conference was held at Biscayne Bay, Florida, regarding local damages to aquatic plant and animal populations of lower Biscayne Bay attributed to the heated effluent from the Turkey Point plant of the Florida Power and Light Company. Because of the selection of the site of the plant at Turkey Point, considerable technical difficulties are being encountered in the disposal of the heated cooling water. Present and proposed treatment measures were found to be inadequate and the conferees have recommended that the excessive waste heat load being discharged from the Turkey Point power plant be reduced to specified levels so that the quality of the waters, including the biological balance of Biscayne Bay, will not be impaired to the detriment of the full enjoyment and use of the Bay.

Subsequently, Secretary Hickel requested the Attorney General to bring suit against the Florida Power and Light Company on the basis of Section 13 of the River and Harbor Act of 1899, known as "The Refuse Act," and other authorities for injunctions against discharges contrary to the heat criteria of the applicable water quality standards, and to restrain construction and operation of power plants which would cause such discharges.

The character of the pollution situation governs the application of the Federal Water Pollution Control Act's authorities and procedures. The Mobile Bay conference of December, 1969, was called under the "shellfish" authority of the Act. Shellfishing areas at Mobile have been closed by the State of Alabama for eight of the past sixteen years. Through this conference, a specific regulatory program for control of municipal and industrial wastes polluting the Bay is being developed.

The Refuse Act, administered by the Secretary of the Army through the Corps of Engineers, extends Federal authority to intermittent discharges of waste into navigable waters and provides a valuable additional enforcement tool. FWQA and the Corps of Engineers coordinate the enforcement of the Refuse Act with the enforcement of the Federal Water Pollution Control Act. Through this coordination and the use of the Refuse Act, regulatory authority can be extended to intrastate waters where no Federal water quality standards apply, as well as to interstate standards violations. The Refuse Act has also been used effectively against "one-time" dumpings of pollutants.

There are limitations in existing enforcement authority which prevent the Federal government from playing a fully effective role. The Federal government may act on its own or at State request to enforce the abatement of pollution which is interstate. In the case of pollution of interstate or navigable waters which occurs only in one State and has its effects only in that State, however, Federal enforcement assistance must be requested by that State. This important distinction results in real complications. Enforcement action on Lake Superior was initiated by the Secretary on his own authority on the basis of interstate pollution which was occurring in tributary border streams. The principal pollution source to Lake Superior, however, was the Reserve Mining Company taconite operations at Silver Bay, Minnesota. To establish enforcement conference jurisdiction over this source, it was necessary to show interstate effects of the pollution from Reserve's operations. If the interstate effect had not been established through FWQA studies, the enforcement conference would have had no jurisdiction over the taconite discharges.

The procedures for enforcement actions also present several limitations on Federal authority. At the conference stage, no direct Federal relation is established with individual polluters. Such parties may not even be compelled to be present at the conference, as no subpoena authority is provided. The Federal authority deals directly with the polluter at the public hearing stage, but, again, there is no subpoena authority to compel the presence of witnesses.

During the post-conference and post-public hearing periods, the States are directed to obtain compliance under their own laws and authorities. The Act directs that a reasonable time, which cannot be less than six months, must be provided to the States for obtaining such compliance. This means that in bringing a recalcitrant polluter to terms, the Federal government's hands initially are tied for at least a whole year. This year stretches to a minimum of 18 months when the time needed to prepare the filing of court action is taken into account.

Despite the acceleration in Federal enforcement activity, deficiencies in the existing legislation have become increasingly apparent. To further strengthen the Federal regulatory role, the Secretary of the Interior has proposed legislative changes in the Act which would provide substantial new authority for FWQA enforcement activities.

Specificially, water quality standards would be strengthened by the addition of effluent requirements and by extending the applicability of these standards to all navigable as well as interstate and certain other waters. These discharge requirements would be established by the States as were the original water quality standards. If the Secretary of the Interior determined that these requirements met the requirements of the Federal Act, they would be enforceable as an element of the Federal, as well as the State standards. The extension of the water quality standards program in terms of more specific requirements and in terms of waters included is a logical progression, building upon the water quality criteria and plans of implementation already in force in all fifty States.

Another significant change would be the extension of geographic coverage of enforcement authority to include all navigable and certain other waters. As has been pointed out, under existing law an enforcement action may not be taken in the absence of an interstate pollution effect without the request of the Governor of the State. Under these circumstances, the availability of Federal enforcement authority depends on the geographic accidents of pollution crossing interstate boundaries. The Administration's proposal would remove the distinction between interstate and intrastate waters and pollutional effect. Federal enforcement authority would be available in any case where the Secretary of the Interior believes water quality standards are being violated or the health or welfare of persons is being endangered.

In addition, the new proposal would extend the coverage of the Act to include the authority to set and enforce standards for groundwaters and for ocean waters beyond the Territorial Sea, two important components of the water environment that need increasing protection.

Furthermore, at the conclusion of an enforcement conference, remedial measures could be required directly of individual polluters. The hearing board phase of enforcement would be eliminated and the government could proceed directly to court enforcement. Fines of up to $10,000 a day for violation of water quality standards or enforcement conference requirements would be authorized. Substantial investigatory authorities would be provided to permit the Secretary to subpoena records and witnesses, to enter and inspect plants and installations and to require testimony. Further, the Secretary would be authorized to request the Attorney General to bring suit under a new injunctive authority to stop waste discharges immediately in cases of serious damages, real or threatened.

Even though the proposed legislation would increase FWQA's regulatory authority, it is intended to back up the enforcement activity of the States, which continue to have primary responsibility. Though at a much accelerated pace and with a much larger scope of enforcement activity, FWQA and the States would continue to work as partners to obtain cleaner waters.

Control of Oil Pollution

With the grounding of the TORREY CANYON in 1967, the breakup of the OCEAN EAGLE in Puerto Rican waters in 1968, and the Santa Barbara offshore oil well leak in 1969, oil pollution has become recognized as a serious national and worldwide problem. These incidents were spectacular in terms of the damages they caused, the control and clean-up efforts and expenditures they necessitated, and the public concern they generated. Of even greater significance, however, is the fact that these major disasters are matched by the aggregate of large and small incidents that occur every day throughout the Nation's coastal and inland waters.

It is estimated that there are annually over 10,000 spills of polluting materials into our Nation's waters. About three-fourths of these spills are oil; the remainder are other hazardous materials, such as chlorine and anhydrous ammonia. The sources of these incidents are vessels, pipelines, rail and highway carriers, land- and water-based storage tanks, refining and other manufacturing operations, the jettisoning of fuel tanks by aircraft, on and offshore petroleum loading and unloading terminals, on and offshore petroleum drilling and production operations, and various other facilities and activities. The problem of accidental spills of oil is further compounded by discharges of oily ballast waters from tankers and other vessels. Pollution from oil and hazardous materials is an everyday occurrence and affects all our waters.

Of particular significance are the potentially large and damaging oil spill accidents that might easily result from the increase in shipping and pipeline transport of oil. The emergence of supertankers as the prime oceanic movers of crude oil imports, the construction of a large pipeline, such as the Trans-Alaska Pipeline System from the new Alaska North Slope oil fields, and the greater development of offshore oil are all contributing factors to the oil spill problem. This rapid increase of oil traffic and the expansion of the offshore production of oil only intensifies the possibility of more frequent and larger accidents and of significantly greater damage to the environment.

Presently, the technology for coping with oil and hazardous materials spills is woefully inadequate. Prevention of accidents is the only sure way of protecting the environment. The Santa Barbara incident and subsequent similar spill situations have shown conclusively that no completely effective techniques are available to control oil spills in the open ocean or lake waters. Wind and wave actions neutralize the effectiveness of oil spill containment devices, such as floating booms. Vacuum or scoop equipment to remove floating oils from the water does not accomplish the job, being effective only in rarely occurring calm seas. Chemical dispersants, sinking agents, and other materials are often ineffective and frequently very toxic to marine and wildlife. Common straw, which soaks up oil so that it can be removed, is still the standard material for fighting and cleaning up oil spills.

Compounding these technological shortcomings, the legal and institutional devices available for handling oil and hazardous material spills have been less than adequate. The Oil Pollution Act of 1924, as amended—the principal Federal legislation in this area of pollution control —prohibited and provided penalties for only the "grossly negligent and willful" spilling or discharging of oils and oily materials. This restrictive legal language essentially precluded enforcement of the Act. This has been rectified by passsage of the Water Quality Improvement Act of 1970, which repeals the 1924 Act and greatly increases the regulatory controls for oil pollution incidents. Many State and local governments, however, are still lacking in oil pollution control authority.

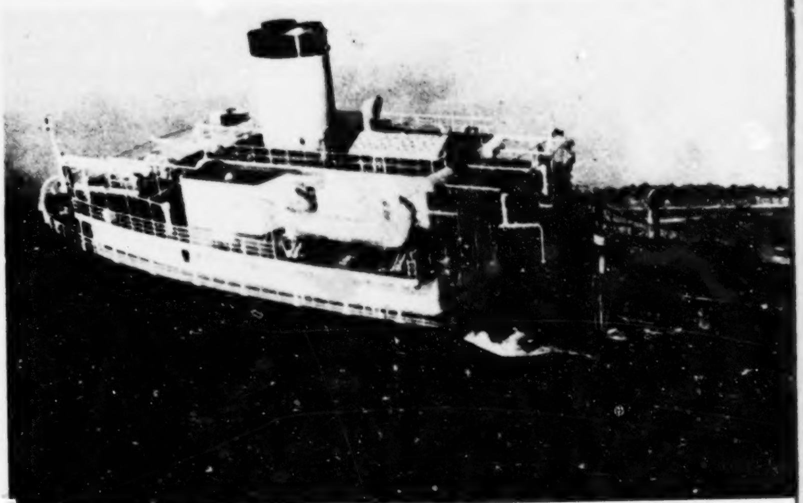
In addition to lack of adequate legal tools, well-organized and well-equipped governmental forces have not always been available to respond in a timely manner to oil pollution incidents. Many of the smaller incidents go undiscovered or ignored by local, State, and Federal agencies; only the larger incidents generally receive the type of response necessary to assure adequate control and clean-up. The usual procedure is to encourage or require the party responsible for the spill to procure the equipment, materials and personnel and to bear the expense of control and clean-up. In some cases, these resources may not be available in the local area, adding yet another problem.

Since the TORREY CANYON incident, and particularly during the aftermath of the Santa Barbara incident, FWQA has played a principal role in organizing and coordinating the Federal, State, and local effort in the control of oil and hazardous materials pollution. This has included development of contingency plans and reporting and response capabilities, pursuit of research and development of new and improved technology, study of potential oil pollution threats—as in the case of proposed exploration and production of oil in Lake Erie—and participating in strengthening of the Federal regulations covering the drilling for and production of oil and gas on the Outer Continental Shelf.

During 1969 and early 1970, the National Multi-Agency Oil and Hazardous Materials Contingency Plan was re-assessed and revisions to strengthen it were undertaken. The first Plan was prepared in 1968, at the request of the President by the Departments of the Interior, Transportation, Defense and Health, Education and Welfare and by the Office of Emergency Preparedness. Together with the supplementary regional contingency plans, the National Plan provides the organizational and communications mechanisms for welding Federal, State and local efforts into a coordinated response to oil and hazardous materials incidents. The Secretary of the Interior has been responsible for the preparation and administration of the National Plan, and FWQA has acted as the lead agency in carrying out this responsibility. The National and regional plans provide for on-scene commanders, operating teams, communication centers, lines of responsibility and other organizational features necessary to bring about an immediate and effective response to major pollution disasters and lesser incidents. The National and regional plans were put into effect during the Santa Barbara incident and proved to be decidedly important in the control and clean-up of that disaster. FWQA is continuing to provide guidance in extending the coverage of contingency plans, particularly in local areas, such as harbor and oil on-loading/off-loading areas, where the threat of oil pollution is greatest. The contingency plans have and are continuing to overcome the institutional shortcomings for coping with spills; and they are becoming increasingly more effective in ensuring that the supply of equipment, materials and other resources, including communications and technical advice, needed to combat oil and hazardous materials accidents becomes immediately available.

In the implementation of the contingency plans in coastal waters, the Great Lakes and the major inland navigable waters, the Coast Guard has provided the on-scene commanders and the principal operating resources, including personnel, ships, equipment and communications systems. FWQA participates by providing advice on containment and clean-up techniques, including the use of dispersants and other chemicals. In other waters of the Nation, FWQA has the lead operating role.

Another important accomplishment during 1969 was the strengthening of the regulation covering the exploration and production of oil and gas on the Outer Continental Shelf. The Secretary of the Interior is authorized to lease lands on the Shelf for oil, gas and mineral extraction and is responsible for regulating these operations, which are in the coastal waters outside of State jurisdiction. The Santa Barbara incident clearly indicated that adequate consideration had not been given to the environmental impact of offshore oil operations. In recognition of this, Secretary Hickel ordered the suspension of pending lease offerings and revisions of the Federal regulations applicable to offshore leasing.



The OCEAN EAGLE breaks up on the rocks, spilling its oily cargo into the sea near Puerto Rico.

The revisions made call for, among other things, the evaluation of potential environmental effects of offshore oil operations prior to lease offerings. Under this feature, FWQA and other Federal agencies concerned with the protection of marine resources are given the opportunity to assess the impact of offshore oil and gas activities. The Secretary of the Interior is authorized to make appropriate decisions on leasing and lease requirements based upon these recommendations. Other revisions of the regulations pertain to the inclusion of the National Contingency Plan and to lessee's responsibilities for pollution prevention, control and clean-up, for the reporting of spills and for the provision of equipment, materials and resources to cope with pollution incidents. The aim of the Department of the Interior is to assure adequate water and environmental quality protection in its management of the Outer Continental Shelf lands and waters, and the strengthened regulations promulgated by Secretary Hickel are directed toward this objective.

With regard to offshore oil and gas regulations, it is also important to note that Secretary Hickel recently recommended to the Justice Department that a grand jury be convened to investigate the violations of Federal regulations by a lessee off the Louisiana coast. The reported failure to provide storm chokes and other protective features required by the regulations is believed to have led to the oil well fires and the large oil discharge from several wells operated by the Chevron Oil Company.

In the area of research and development, the Federal agencies have divided among themselves the work necessary to find new and improved technology to deal with oil and hazardous materials pollution. FWQA has taken on the primary tasks pertaining to prevention, containment and clean-up in sheltered and inland waters, the fate and ecological effects in these waters, and the technology for cleaning oil contaminated beaches. The Departments of Transportation, Defense and Health, Education and Welfare, as well as other agencies of the Department of the Interior, are assuming primary responsibility for other pertinent areas of research, including the combating of oil pollution in open waters.

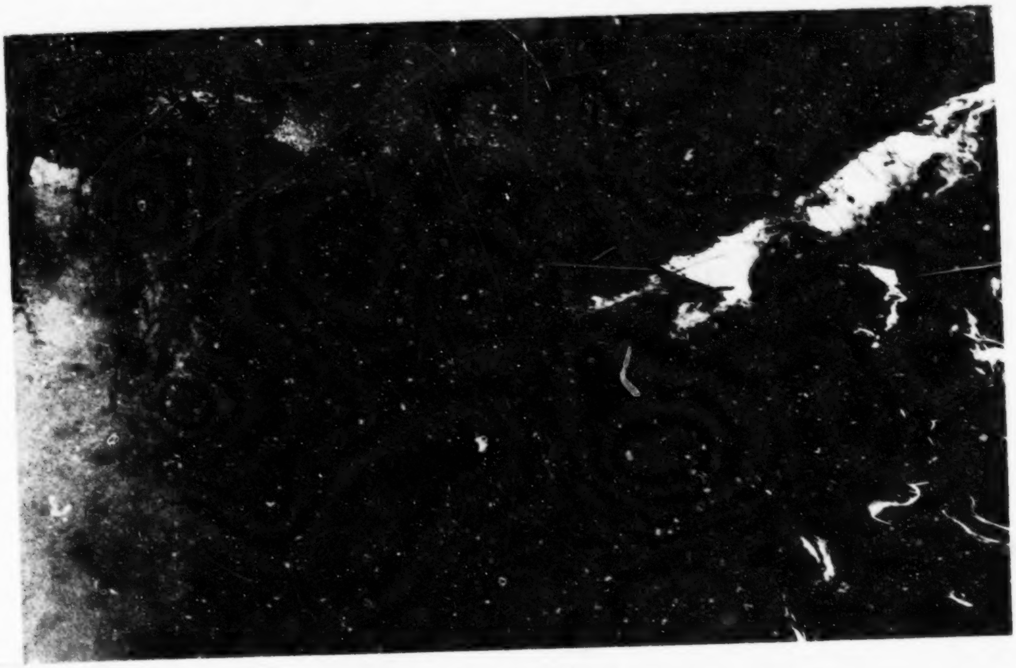
FWQA's research activities are being carried out under grants and contracts, as well as through in-house work centered in its laboratory at Edison, New Jersey. One project consists of investigating the use of gelling agents. These could be released into the oil cargo of a tanker to form a semi-solid material when an accident causes a rupture in the vessel. This material either would not leak out of the ruptured tanks or, if released, could more easily be contained and picked up. Other efforts are aimed at developing and demonstrating oil containment and recovery equipment, barrier devices to protect marinas and other water areas from incoming oil slicks, and techniques for cleaning oil from beaches and disposing of the material removed.

In its day-to-day operations, FWQA operates a teletype communications systems covering the Headquarters and Regional Offices to handle reports and information on oil and hazardous materials spills, as well as other emergency situations, such as fish kills. Under the contingency plan, to the extent possible, personnel in Regional and field offices respond to pollution incidents by inspecting and collecting samples and information on the situation, by providing technical advice on control techniques, and by participating in the direction of control activities. In these activities, particularly in coastal waters, FWQA and the Coast Guard and/or the Corps of Engineers work together—each agency performing those tasks which it is best organized and equipped to handle.

Although FWQA has not had the resources to respond to most spill incidents, it has responded to all major episodes. Substantial on-scene effort was put into the Santa Barbara disaster. This was followed by responses to the many serious pollution problems resulting from Hurricane Camille; to the large release of oil from a ruptured storage tank at Seawarren, New Jersey; to a number of oil spill incidents in Alaska, including the recent oil disaster affecting 1,000 miles of shoreline along the coast of Kodiak Island; and to some 130 other incidents, about 40 of which were hazardous materials situations.

Although a considerable amount of attention is devoted to reporting and response activities, a

Oil pollution on the Jackson River in Virginia.



Experts attempt to control one of eight blazing oil wells off the Louisiana coast with dynamite. Until these wells were controlled, about 1,000 barrels of oil a day threatened the Louisiana Coast.

significant effort has been and is directed to other program activities. These include contingency planning; evaluation of potential pollution situations and impacts, including those associated with offshore oil drilling and production; testing of hazardous materials and the neutralizing or combating agents needed to deal with them when a spill occurs; participation in international meetings on oil spill prevention; and technical assistance to State and local agencies and other groups.

Along these lines, several significant actions were undertaken in 1969. The bunker oil from the grounded motorship, NORDMEER, which threatened to rupture and spill its contents into Lake Huron, was removed to prevent a serious incident. This was the first effort of its kind by FWQA.

In the case of the Kodiak Island incident, Secretary Hickel has appealed to ten major oil companies to enter into a voluntary "no discharge" agreement to halt the oil pollution caused by vessels pumping their oily ballast waters into the high seas outside of the 50 mile limit. These areas are not addressed under international controls. Investigations by FWQA have shown that the oil-contaminated ballast waters released by commercial tankers enroute to terminal facilities in Cook Inlet were the most probable cause of the Kodiak Island disaster, which involved the destruction of an estimated 10,000 waterfowl. The discharge of oily ballast waters on the high seas is a frequent source of pollution. Many stretches of shoreline along both coasts are affected by oil believed to have drifted in from offshore ballast water pumping operations and it is the goal of the Department of the Interior to prevent these incidents by proper handling of ballast waters.

Proposed drilling for oil and gas in Lake Erie was studied, and, as a result, recommendations were made to the State of New York and the International Joint Commission opposing oil production and encouraging the strictest regulation of gas production in order to protect the valuable water supply, fishery and other uses of the Lake. Considerable attention has also been devoted to a study of the Alaska North Slope oil development and the Trans-Alaska Pipeline System to assure that adequate consideration for maximum protection of the unspoiled environment is taken in the design, construction and operation of these facilities. Along similar lines, technical assistance was given to the State of Maine in its preparation of comprehensive regulations for the prevention and control of potential pollution in all types of oil operations.

These activities and others were essentially wholly aimed at pollution prevention, a goal which FWQA believes must be ultimately achieved through fail-safe systems and practices if real control of oil pollution is to be attained.

The recent passage of the Water Quality Improvement Act of 1970 substantially strengthens the Federal law and authority to prevent and control oil pollution. Most importantly, this new legislation removes the restrictive definition of illegal spills and discharges and provides notification requirements and substantial penalites and liabilities for oil spills. These features, including the requirement for the showing of financial responsibility—or liability insurance—will promote greater care and effort on the part of the oil and oil transportation industries in the prevention of spills. Other provisions authorize greater effort by the Federal agencies in developing strengthened contingency plans, directing or fully undertaking the containment and clean-up of oil spills and providing a revolving fund to cover the costs of the latter. FWQA recently created the Office of Oil and Hazardous Materials and is expanding its staff to handle the increased work load resulting from the new legislation.

Control of Vessel Wastes

The discharge of wastes from ships, barges, houseboats, pleasure craft and other types of watercraft has been receiving increased attention in the nationwide effort to clean up polluted waterways and preserve clean streams, lakes and coastal waters. Until recently, the effect of vessel wastes has been obscured by the pollution resulting from municipal and industrial waste discharges and other causes. With the progress anticipated in abating municipal and industrial waste discharges, the significant increase in the number of toilet and galley equipped vessels—particularly pleasure craft—plying the Nation's waterways and lakes, and the greater demands for high quality recreation and sport fishery waters in those areas most used by both commercial and non-commercial watercraft, vessel wastes have emerged as significant source of water quality impairment. Accordingly, vessel waste discharges are currently a concern in the navigable waters of this country, including even mountain lakes where the intensity of vessel use is relatively low but the need for the protection of the high quality water is great.

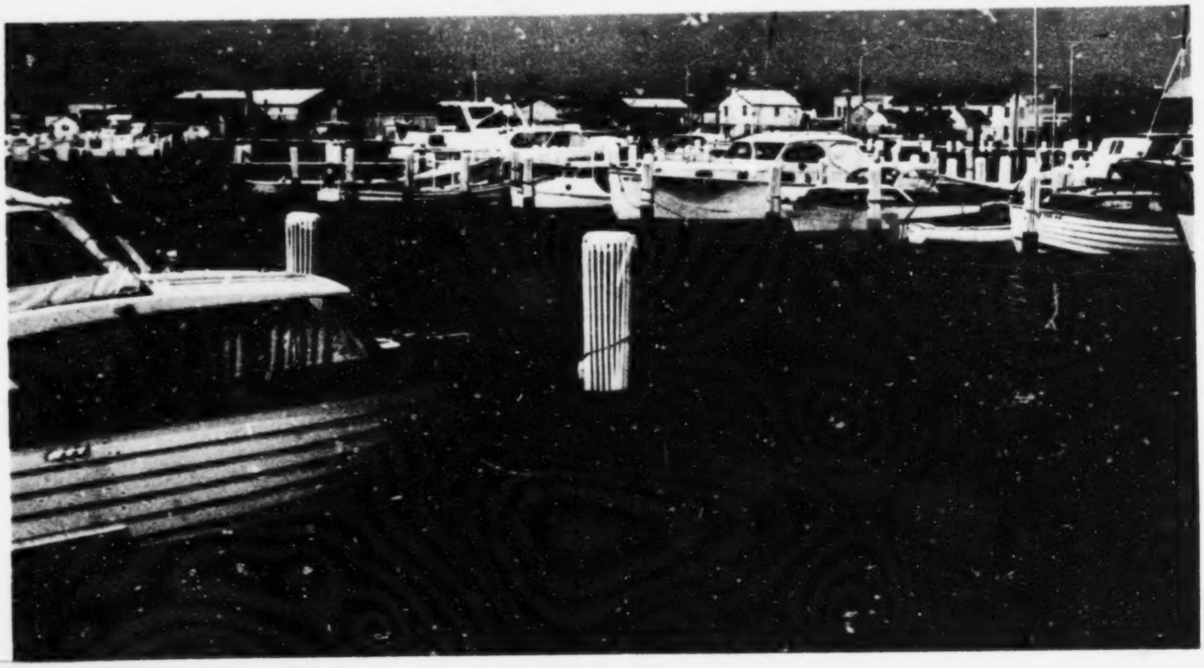
In June 1969, FWQA completed a report of its San Diego Bay Vessel Pollution Study Project following intensive field and laboratory activity. The purpose of this project was to determine the magnitude, extent and kinds of pollutional effects to be expected from the discharges of shipboard sanitary wastes and the pollution abatement measures required to reduce or eliminate these discharges. The findings were illustrative of this problem: vessel waste discharges were found to cause serious bacterial pollution, to be responsible for bottom sludge deposits and floating waste material and to cause violations of the water quality standards established for San Diego Bay. The pollution was directly attributable to the high numbers of military, commercial and pleasure vessels using the Bay.

Investigations by State agencies and FWQA have discovered similar conditions in other bodies of water across the United States. Bacterial pollution and the attendant impairment of recreational water uses are the principal adverse effects of untreated vessel waste discharges, but the occurrence of aesthetically displeasing floating material follows close behind in pollutional importance.

It will not be an easy task to remedy vessel waste pollution. The weight and volume of waste treatment devices or waste handling tanks cause considerable installation problems, particularly on existing vessels, especially if they are military. The expense of control devices, particularly to pleasure craft owners, is also a factor. A considerable amount of research and development is underway by Federal agencies including FWQA, the Navy and the Coast Guard to find adequate and adaptable waste control systems. Consideration is being given to incineration devices, modified versions of conventional waste treatment methods, recirculation systems, chemical-toilets—such as are used on commercial aircraft—and other devices. Good progress is being made, and there appears to be little doubt that American ingenuity can and will develop the technology required to adequately handle vessel waste pollution problems.

Within recent years, many of the States have enacted or strengthened their legislation or regulations pertaining to the control of vessel

Sanitary wastes discharged from pleasure craft are a significant source of pollution.



wastes. Unfortunately, the non-uniformity of the waste treatment and control requirements imposed by these States has presented some significant compliance problems for vessels which travel between States. Also, in many cases the State regulations do not apply to or are ineffective in their coverage of interstate and international carriers and Federal vessels. In response to these basic problems, the Congress recently enacted comprehensive Federal legislation—the first legislation of this type—covering the control of vessel wastes.

The Water Quality Improvement Act of 1970 provides for the establishment of performance or effluent standards for the sanitary waste discharges from all classes of watercraft. These standards are to be set by the Secretary of the Interior. The amendment further provides for the establishment and enforcement of regulations to implement these standards by the Secretary of Transportation, under whose administration the Coast Guard comes. This Federal statute applies to new and existing vessels and provides for penalties for the failure of vessel owners and manufacturers to provide adequate shipboard treatment or control of sanitary wastes. Importantly, this new legislation provides for uniform, nationwide regulation of watercraft waste discharges. This will promote a comprehensive attack on vessel pollution problems by FWQA and the Coast Guard, who will join in carrying out this task.

During the past year, FWQA has been preparing for its role under the new legislation. Research, development and demonstration of vessel waste treatment devices have been pursued and considerable assistance has been given to other Federal agencies, including the Navy, the Corps of Engineers and the Coast Guard, in the development, testing and installation of treatment and control equipment on Federal vessels. With the eactment of the new legislation, FWQA's activities in the vessel wastes area will be expanded. FWQA is planning to consult with the boating industry, the manufacturers, and others concerned with treatment devices and will hold public hearings prior to the establishment of standards. In addition, assistance will be given to the Coast Guard in establishing both the regulations necessary to implement the performance standards and an adequate certification program. Finally, assistance will be provided Federal agencies in equipping Federal vessels with adequate control equipment. The new legislation provides the means to fully abate the pollution arising from watercraft sanitary wastes, and FWQA plans to move rapidly forward to meet this objective.

Control of Pollution from Federal Activities

The Federal government is involved in many activities which have an impact on the quality of our Nation's waters. These operations include the maintenance of Federal facilities, such as military bases, lighthouses and post offices; management of Federal lands; and diverse activities, such as dredging, nuclear energy development, and pest control. Today, in the United States, there are approximately 20,000 Federal real properties, many of which have an impact on the environment. In addition, Federal lands comprise one-third of the United States, and the use of these lands has a bearing on progress in achieving national goals of clean water and a quality environment.

Abatement and prevention of pollution from these sources is a major Administration goal. On February 4, 1970, the President issued Executive Order 11507, establishing a new and aggressive approach to the problem of keeping the Federal house clean. The Order superceded earlier Executive Orders on water and air pollution control.

In issuing this Order, the President gave more specific direction to Federal agencies in the conduct of their activities with regard to environmental protection than had any previous Order. To establish the Federal government as a true leader in the battle to save the environment, he required that all projects or installations owned by or leased to the Federal government would have to be designed, operated and maintained so as to conform with water and air quality standards. For the first time, a conformance date for Federal compliance, December 31, 1972, was established and written into the Order. The Presidential statement accompanying the Order set forth a $359 million program for obtaining this objective. To insure that these funds, once appropriated, were utilized for the purposes intended, the Order contained a section which, in effect, prevented use of the appropriated funds for purposes other than pollution control.

FWQA has an important role to play in working with the other Federal agencies concerned to assure that the objectives of the Executive Order are met. FWQA has primary responsibility for reviewing and approving permissible limits of waste discharges from such installations and for coordinating the water pollution control activities of Federal, State, and local programs. The new order contains important provisions to insure this role will be an effective one and to correct some of the administrative problems brought about by earlier Orders. Rather than have professional staff at all levels of government review plans and specifications for improved abatement facilities, the Order requires that specific performance requirements for each facility be set by the agency and approved by the Secretary of the Interior. In evaluating the adequacy of the performance requirements, the Secretary is to take into consideration water quality standards where such standards exist. The Secretary is also given, for the first time, the authority to issue regulations establishing water quality standards for the purposes of the Order where such do not exist. More importantly, the Secretary is also authorized to establish more stringent requirements for Federal facilities than contained in existing standards. Both of these actions are to be taken after consultation with appropriate Federal, State, interstate and local agencies.

FWQA has taken a number of steps to meet these and related responsibilities. The staff assigned to work with the other Federal agencies has been restructured and enlarged. Increased emphasis has been placed on better channels of communication and cooperative relationships with the other Federal agencies. Fruitful meetings and seminars have been held at which Federal programs have been reviewed, information exchanged, and advice both sought and given.

FWQA conducts on-site inspections of waste-water treatment and disposal practices at Federal installations to advise the agencies concerned as to the adequacy and effectiveness of such measures. This information is used by agency planners to develop and update plans for corrective actions. Whenever possible, these inspections are conducted jointly with State officials to promote better Federal-State relationships.

From the information collected on such inspections, a system of recording and reporting information on Federal installations and their waste treatment needs and accomplishments was developed in 1969. This system will be the basis for a comprehensive inventory of Federal installations, which will streamline the review process and provide better information on which to recommend nationwide priorities to the Bureau of the Budget and Congress.

To facilitate budgeting for corrective measures, Federal agencies are required to present to the Bureau of the Budget a plan for installing improvements needed to meet the target date. FWQA reviews the agencies' plans and recommends priorities for funding to the Bureau of the Budget. Each project is ranked in the order of its priority to ensure that the most significant problems will receive first attention.

Emphasis has been placed on conferences to ensure that information on improvements in waste treatment technology would be available to Federal agencies. In this regard, a seminar was held for representatives of other agencies on new advances in waste treatment technology and was geared to problems routinely faced at Federal installations. Attendance of agency personnel at seminars conducted by FWQA's Research and Development program has been encouraged. A field trip was arranged for officials of the Department of Defense in order to familiarize them with the new treatment technology being developed at the Blue Plains sewage treatment plant in Washington. Reports of completed FWQA research projects are being made available to the appropriate Federal agencies for their consideration in the development of new facilities, and incorporation of these newly developed techniques in remedial work is being highly encouraged.

Correction of conventional municipal and industrial waste problems from Federal facilities is only a part of the job in ensuring that the wide-ranging activities of the Federal establishment have a minimum impact on the environment. New opportunities for pollution abatement are continually being brought to the attention of other agencies. As the wastes from conventional point sources are brought under control or eliminated, the wastes from nonpoint sources come to the forefront as significant problems.

One such area receiving recent attention was related to management practices on Federal lands. In the past year FWQA chaired a Department of the Interior task force established to assess the effect of Federal land management practices on water quality. A pilot review study conducted in Oregon showed a major need and opportunity to reduce water pollution associated with Federal land management practices and conservation measures. The report, *Federal Land Management Practices and Water Quality Control*, found serious damage to the environment stemming from long-established practices, as well as from more recent practices involving pesticides, fertilizers, and other chemical applications. The report specifically identified 12 kinds of land management practices and 22 conservation measures having an impact on water quality. These would be reviewed by agencies and altered whenever necessary to conform with national environmental goals.

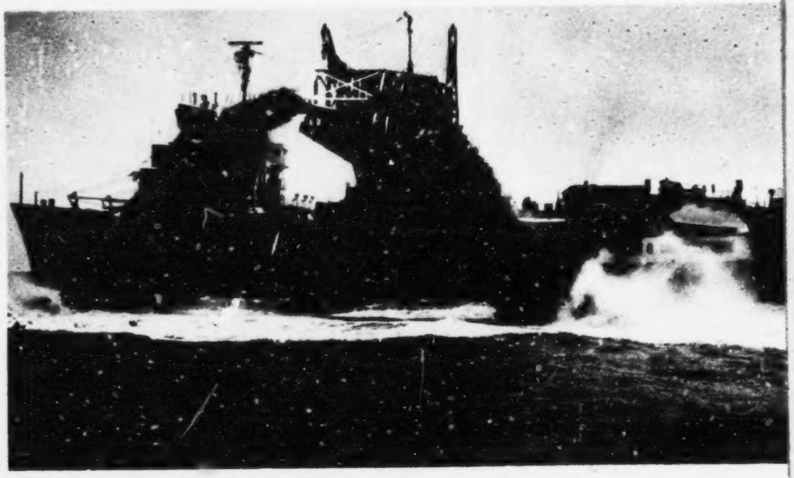
Operation Plowshare, the Atomic Energy

Commission's program to develop peaceful uses of atomic energy, represents another activity which must be carefully monitored and controlled to avoid unwanted effects on the environment. This program has and will involve nuclear explosions designed to stimulate gas production in oil and gas bearing formations, to fracture mineral formations to enable extraction by leaching, to develop storage for water or other materials. To assure that the program, as planned, provides adequate safeguards for water quality, FWQA provides review and advice to the Commission concerning these experiments. Careful planning of the program, as well as pre- and post-detonation surveillance, is essential because of the potentially great hazards involved.

The Corps of Engineers' dredging activities in the Great Lakes and elsewhere are yet another cause for concern. For more than 100 years the Corps of Engineers has been dredging material from the harbors of the Great Lakes and depositing most of the dredged material in designated dumping areas in the open waters. Growing concern over the resulting effect on the Lakes led to completion last year of a Corps of Engineers' pilot program related to dredging and water quality problems in the Great Lakes. Among the conclusions of the Corps' study were that heavily polluted sediments when transported to the open waters must be considered presumptively undesirable because of their possible long-term effects on the ecology of the Great Lakes, as evidenced by bio-assays of the effects on bottom organisms and plankton, and that disposal in diked areas would be the least costly effective method of withholding pollutants associated with dredgings from the Lakes.

On April 15, the President sent a message to the Congress, proposing legislation to discontinue open water disposal of polluted dredge spoil in the Great Lakes. The legislation would authorize the Corps to construct and maintain contained disposal facilities, in cooperation with States and other non-Federal interests. Dredge spoils from Federal and non-Federal operations would be disposed of in these enclosed areas under appropriate cost-sharing arrangements.

We also must be increasingly alert to the environmental impact of such diverse activities as Forest Service timber sales in Alaska, use of persistent pesticides for quarantine control at Federal airports, and proposed development of oil shale lands in Colorado, Wyoming, and Utah. FWQA will place increasing emphasis on working with the agencies concerned to correct deficiencies and to prevent environmental problems from arising in the future.

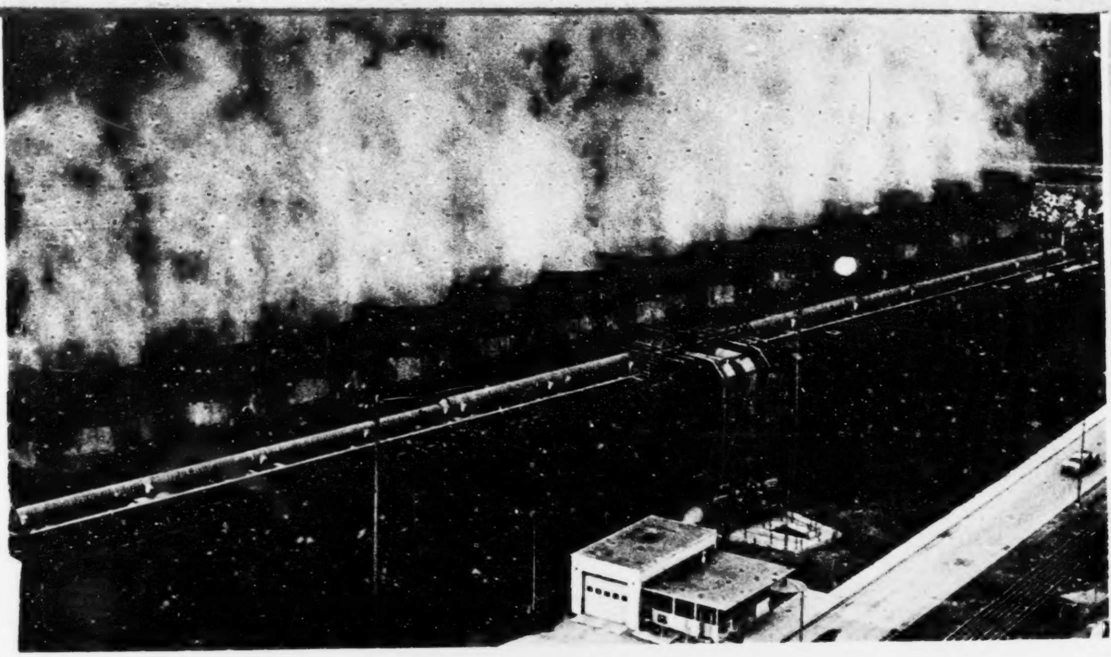


Dredging, often necessary to keep navigation channels open, is a source of pollution when spoils are dumped in open waters.

Control of Pollution from Federally Licensed and Supported Activities

Closely related to pollution resulting from direct Federal activities, is the environmental impact of the various functions conducted under loans, grants, contracts, leases and permits from the Federal government. These diverse activities range from the nuclear power plants receiving licenses from the Atomic Energy Commission to urban renewal projects financed by the Department of Housing and Urban Development. Combined, these Federally supported and licensed activities constitute a real and potential threat to the environment, which cuts across the full spectrum of the Nation's economic life. They also reflect an unusual opportunity for the Federal government to extend the exercise of its responsibilities for pollution control.

Two landmark pieces of legislation and an implementing Executive Order promise effective action. The National Environmental Policy Act of 1969 called for all agencies of the Federal government to give full attention to environmental protection in their planning activities and decision making. In furtherance of this legislation, the President issued an Executive Order on March 5, 1970. This Order directed the heads of all Federal agencies to review their statutory authority, administrative regulations, policies and procedures, including those relating to loans, grants, contracts, leases, licenses or permits, in order that they might identify deficiencies and inconsistencies which keep each agency from full compliance with the national



Cooling towers are used to dissipate huge quantities of heat produced by steam electric power plants.

environmental goals established by the Act. The Order requires a report to the Council on Environmental Quality on the results of this review along with corrective actions taken and planned.

Recent enactment of the Water Quality Improvement Act of 1970 gave further impetus to this trend. The Act provides that any applicant for a Federal permit or license to construct or operate any facility which may result in any discharge into the navigable waters of the United States shall provide certification from the State in which the discharge originates that such facilities or related activities can be expected to comply with applicable water quality standards. The Act further provides that no license or permit shall be granted without such certification and such conditions as the State may reasonably require, including but not limited to provision for suspension or termination of any issued license or permit for failure to be in compliance with applicable water quality standards. It also provides special conditions under which the views of an adjacent State will be obtained; or an interstate agency or the Secretary of the Interior, if appropriate, may provide the certification.

The legislation is clear in its intent that the States are to exercise primary responsibility for the administration of the water quality standards for their waters and for the assurance that State-Federal water quality standards are met by anyone who uses these waters, and that FWQA is to cooperate with other Federal agencies, with State and interstate agencies, and with water users in assuring that appropriate control measures are applied to meet the water quality standards. The legislation provides that the Secretary of the Interior shall provide, upon the request of any Federal department or agency, or State or interstate agency or applicant, any relevant information on applicable water quality standards and comment on any methods of complying with such standards.

The major and most significant activities to receive immediate attention under this legislation are those of the Atomic Energy Commission, which issues construction permits and operating licenses for nuclear power plants; those of the Federal Power Commission which licenses hydroelectric power plants and whose approval must be secured before changes can be made in those projects, including use of project waters and construction across project lands; and those of the Corps of Engineers which issue permits for dredging and construction in the navigable waters of the United States (except where hydroelectric power production is contemplated and licensed by the Federal Power Commission).

Prior to the enactment of recent legislation and the issuance of the Executive Order, cooperative arrangements had been made with the Atomic Energy Commission, the Federal Power Commission and the Corps of Engineers to review materials submitted in request of Federal permits or licenses for activities which could result in water pollution. These reviews have been conducted in coordination with other Department of the Interior agencies concerned with environmental protection. FWQA has reviewed these applications to determine the possible effects of the activity, as proposed, upon water quality. Recommendations have been made as to the need for additional control facilities and any provisions which should be included in the permit or license to ensure that water pollution would be controlled. These activities have led to an increasingly well-coordinated and cooperative effort to ensure that water pollution control measures are considered in connection with the issuance of a Federal license.

These arrangements have been satisfactory, however, only in part. For example, there has been a serious inadequacy in procedures for review of environmental factors in design and site selection for new fossil fueled or nuclear power plants.

With respect to nuclear plants, the Atomic Energy Commission receives comments on environmental factors from the Department of the Interior in accordance with established administrative procedures. These comments are forwarded to the applicants for consideration. The Atomic Energy Commission, however, has held that it lacks regulatory authority to incorporate in its licenses for nuclear plants requirements for measures to protect the environment beyond radiation safety hazards. This position has been supported by the Department of Justice and also affirmed in a court decision.

Fossil fueled plants are licensed by State regulatory authorities and require no Federal license whatever. With public concern about the environmental impact of power developments running high, a number of utilities have entered into voluntary discussions of projects under consideration with concerned State and Federal agencies. There has been, however, little or no opportunity for the Department of the Interior to require environmental protection measures in the plans for power plants, both nuclear and fossil fueled, unless they used water from the reservoir of a licensed hydroelectric project.

By contrast, there have been adequate procedures for environmental review in the category of hydroelectric power plants. Over the years, the Federal Power Commission prior to issuing a license for the construction of hydro plants has increasingly incorporated environmental protection requirements. These have included, for example, minimum flows for fisheries and water quality below licensed dams, fish screens and spawning channels, and the making available of project lands for public recreation.

Many proposals for incorporating these measures come from Department of the Interior agencies. FWQA has the opportunity to review license applications made to the Federal Power Commission and to propose changes in construction and operation plans on behalf of water quality improvement. It has received excellent cooperation from the Federal Power Commission in incorporating recommended measures in its licensing procedures.

A prime example of the application of this policy is the Blue Ridge case on West Virginia's Kanawha River. Although this case is still pending before the Federal Power Commission, the preliminary finding provided for the development of a project which would require the power company to provide flows for maintenance of water quality in the downstream reaches of the Kanawha River.

The activities involving dredging and construction in navigable waters of the United States and requiring permits from the Corps of Engineers constitute another category of pollution. The discharge of dredged materials into the Great Lakes by private dredgers is directly comparable in effect to the discharge of dredgings from Corps operations. This illustrates the importance of applying the same stringent environmental controls to Federally licensed activities as to the Federal agencies themselves.

FWQA and the other Interior agencies concerned review thousands of applications for such permits annually. Comments to the Corps of Engineers have resulted in inclusion of provisions to protect water quality in some permits and in the withholding of other permits. However, major difficulties have remained. The inclusion of specific provisions relative to control of pollution in Corps of Engineers' permits has been contested in the courts. A lower court decision that the Corps of Engineers is not authorized to include such restrictions in its permits is being contested by the Corps of Engineers.

Enactment of the Water Quality Improvement Act of 1970 represents a major improvement in procedures and methods. The Act's emphasis on compliance with water quality standards as the basic mechanism for ensuring water quality protection is of great significance. Nevertheless to adequately ensure the effectiveness of these new requirements, FWQA must place continued emphasis on development of adequate standards. At present, there are no standards that adequately ensure protection of water quality from the impacts of dredging, and the temperature standards of many States remain unimproved. In order to provide effective implementation of the Water Quality Improvement Act, within the concepts outlined by the Congress, FWQA must and will accelerate its efforts to obtain adequate water quality standards.

ASSISTANCE PROGRAMS

From the very start of the water pollution control program, the Congress has made it clear that the responsibility for preventing and controlling water pollution begins at the State and local levels. And, although the Federal government has been given an increasingly greater hand in dealing with the problem, the States and communities continue to bear a major share of the responsibility.

The job of controlling pollution, as indicated earlier, is an enormous one both in terms of costs and in terms of manpower requirements. Few, if any, State and local governments have revenues large enough to meet the many and increasing demands, including water pollution control, confronting them. The largest share of the Federal program's resources are therefore spent for direct assistance to States and communities—grants for treatment plant construction and program development, technical assistance, and manpower development—to help meet the national goal of clean water.

President Nixon has proposed in his program of "New Federalism" that State and local governments play an increasingly important role in meeting national needs. At the same time, he has recognized the need for vigorous Federal leadership, through solid backup of State and local actions, in restoring the environment.

To ensure more effective working relationships, the President has directed nine Federal departments and agencies to work together to modernize the management of their presently complex systems of providing financial and technical assistance to State and local governments. The Department of the Interior is working to implement the objectives and goals of the Federal Assistance Review (FAR) program. One of the primary objectives sought is the simplification of the Department's grant programs —streamlining of the application process and organizational structure of assistance programs for efficiency, economy, and responsiveness to State and local needs. The Federal Water Quality Administration (FWQA) has responded to the challenge. A detailed analysis of the administrative requirements of the Construction Grants and the State and Interstate Pollution Control Grants programs is currently underway.

Secretary Hickel has also stressed the need to improve Federal working relationships with the States. In order to improve communications with States, FWQA representatives are attending public meetings of the State water pollution control boards and other appropriate meetings, such as those of legislative committees. Technical assistance is also being increased to make more of an effort to meet State needs within available resources. Increasing emphasis will be placed on coordinating State and Federal program planning to ensure the most effective pooling of resources.

Assistance to Municipalities

Rapid growth of population and its continuous trend toward urban centers has resulted in a tremendous increase in the volume of municipal wastes and in the need for an enormous investment in waste treatment facilities. National attention was focused on this problem in 1956, when the Congress, in the first permanent Federal Water Pollution Control Act, initiated the program to provide Federal grant assistance to communities to improve or build sewage treatment facilities. Amendments since that time have helped step up construction activity by making more money available and on a more liberal basis.

Under today's legislation, a community can get financial help in the construction of a municipal waste treatment plant with a Federal grant of at least 30 percent of the construction cost. Under certain conditions, such as matching State financial aid, approved water quality standards, and a comprehensive plan for approaching the problem, the Federal share may be much higher.

Since 1957, the Federal government has provided nearly $1.5 billion for construction and expansion of over 10,000 municipally owned and operated sewage treatment facilities. These funds have assisted the States and communities in the construction of $6.4 billion of treatment works.

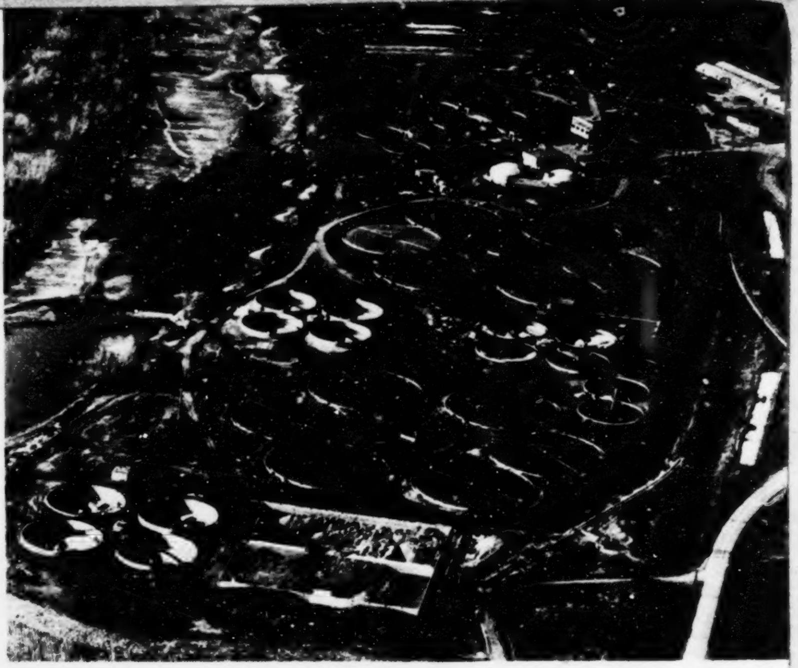
In the thirteen years in which such grants have been available, the population served by some degree of waste treatment has increased by more than 51 million persons. More than 92 percent of the population served by sewers is connected to a waste treatment plant, as contrasted with 57 percent in 1956. These represent significant accomplishments.

Despite this progress, the Nation still lags far behind in providing modern waste treatment for its cities. Many of the works constructed were designed to provide levels of treatment which subsequently have proved inadequate to protect receiving waters. Other works have become overloaded and need major expansion. Improper operation and maintenance of many of these plants has resulted in discharge of wastes little reduced in polluting content and in breakdown and early obsolescence of facilities. Other plants have been poorly located and have resulted in fragmented, rather than systematic, regional solutions. Population growth has added additional needs; during the same years that the construction grants program was underway, the population connected to sewers for which treatment must be provided increased by 37.5 million persons. Increasing standards of living and the rising use of household chemicals and appliances, such as garbage grinders, have added an additional dimension. In many river basins, progress in treating the wastes from some of the communities has been offset by failure to deal with other waste sources.

Construction needs have far outpaced Federal, State and local funds and there have been recent efforts to increase available funds. A number of States have enacted measures to financially assist their communities. At the Federal level, the Congress this year appropriated a record $800 million to finance the Federal share of doing the job. It will not be enough, however, to merely provide additional funds under existing formulas and methods. A number of basic improvements are needed.

The FWQA has become increasing aware that major revisions in this key program—its legislative structure, funding, regulations, and administration—are necessary if the nationwide goals of providing adequate waste treatment and meeting water quality standards are to be accomplished efficiently and in the near future. A major objective over the past year has been to review the program in depth to determine what changes were needed. The General Accounting Office has also had the program under review and has made a number of recommendations for improvement.

Our review contributed to the formulation of the proposed new legislation and regulations to administer the program on a more systematic basis. These are an essential element of the Administration's environmental program. This review clearly indicated that there were three basic objectives which should be met to achieve an equitable and fully effective Federal financing program. First, the level of financing should be adequate to enable the Nation's communities to get abreast of their pollution problems. Second, the method of financing should be an assured one, in order to enable State and local governments and the construction industry to plan and gear up for the necessary effort. Third, the program must be designed to ensure that the funds will be spent efficiently to achieve the best results in cleaning up our waters.



Treatment facilities such as this one are built with the help of Federal construction grants.

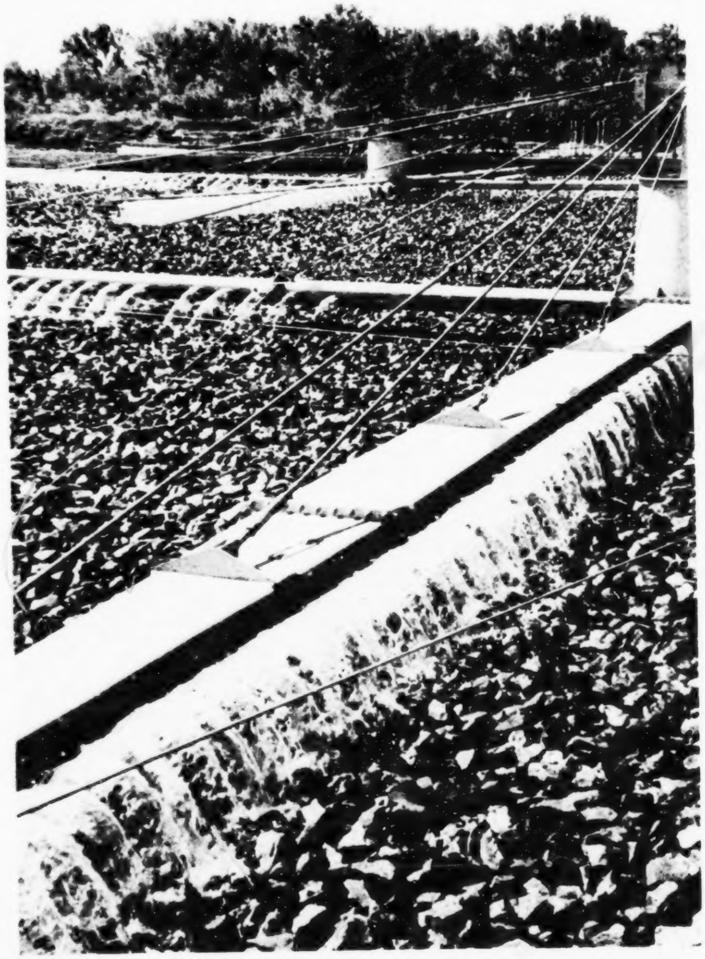
The legislation proposed to the Congress by Secretary Hickel is designed to provide funds adequate to do the job. The legislation calls for a four-year Federal contribution of $4 billion in a construction program of $10 billion, the Federal share to be matched by $6 billion in State and local funds.

This is based on the determination, through FWQA's recently completed cost studies, that a $10 billion investment in waste treatment facilities is needed to meet the country's municipal waste treatment needs in the years immediately ahead. Although these cost studies, the most comprehensive ever completed, indicate that $10 billion will be enough, President Nixon has said more money would be available if necessary. The proposed legislation provides for a reassessment in 1974 to evaluate needs for the following five years. The legislative proposal would also revise the present method of allocating grants to permit a higher degree of flexibility in directing funds to areas where the need is greatest and where they can be most effectively used.

The proposed legislation also stresses measures to provide assurance to States and communities that Federal funding will be forthcoming as planned. The lag between Federal authorization and appropriations in the present legislation created a condition of confusion and uncertainty that has hampered the engineering and construction industry from gearing up for a sustained level of effort.

Ensured funding is a key component of the

Aeration tanks and trickling filters are components of municipal waste treatment processes which reduce organic loadings to streams.



proposed legislation; it would enable the Federal government to enter "grant agreements" with municipalities at the rate of $1 billion a year for four years. Pursuant to these agreements, the Federal government would be obliged to appropriate funds to satisfy obligations under these grant agreements, just as the Federal government must satisfy any other of its debt obligations. This change would assure communities of full Federal support and allow planning and construction to proceed without the traditional gap between funds authorized and funds appropriated.

The Administration has further emphasized its intent to provide assurance of funding and to alleviate State and local uncertainty by resolving the reimbursement issue. To permit States and communities to move ahead with construction of waste treatment works before full Federal funding became available, the 1966 amendments to the Act provided that the allotments of a State could be used for reimbursement of projects which went ahead with less than the full Federal share and on which construction was initiated after June 30, 1966, provided that such projects met all other Federal requirements. As a result of this provision, a number of the States went ahead with bond issues or other provisions for prefinancing the Federal share on those projects which proceeded with either no Federal funds or less than the full Federal share. As of December 31, 1969, a total of 880 such projects had proceeded. The amounts earned for Federal reimbursement were $322 million. When all these projects are completed, eligible reimbursements will be about $814 million.

Federal intentions with respect to repayment of these funds has been one of the vexing problems facing States and communities which had moved ahead on their own. In addressing the State Governors' Conference in Washington this February, President Nixon expressed his position regarding repayment of these funds. He stated that, "any State that went forward after the Clean Water Restoration Act of 1966 relying on what the Federal government had indicated, went forward in its own program, should not be penalized because it took that initiative. As a matter of fact, it should be rewarded."

Under the proposed legislation, reimbursement would be accomplished through the larger appropriations; through improvements in the reallotment procedure which would more quickly funnel funds to areas of greatest need; and through use of discretionary authority, which would permit the Secretary to assign a portion of each year's available funds to such areas.

An additional element of the Administration's program will help assure that State and local bodies will be able to borrow the necessary funds to do their share. The Department of the Interior's proposed legislation would be supplemented by a Treasury Department proposal to establish an Environmental Financing Authority (EFA). EFA would have authority to buy the waste treatment bonds of those municipalities who are unable to sell their bonds on the open market. EFA would ensure the availability of local financing for construction of waste treatment plants, so all communities would be able to participate in the construction grants program.

Higher appropriations and revised legislation are only part of the answer in accelerating the systematic construction of municipal waste treatment plants to achieve effective results in cleaning up pollution. Development of measures to ensure efficient use of funds to achieve that result has been a key element of FWQA's new approach to the administration of the program.

Secretary Hickel has said, "The job ahead will be costly. We want to ensure that the Federal funds invested in the clean-up will be spent effectively and fairly." Towards this end he has published proposed regulations in the Federal Register. The proposed new rules are that:

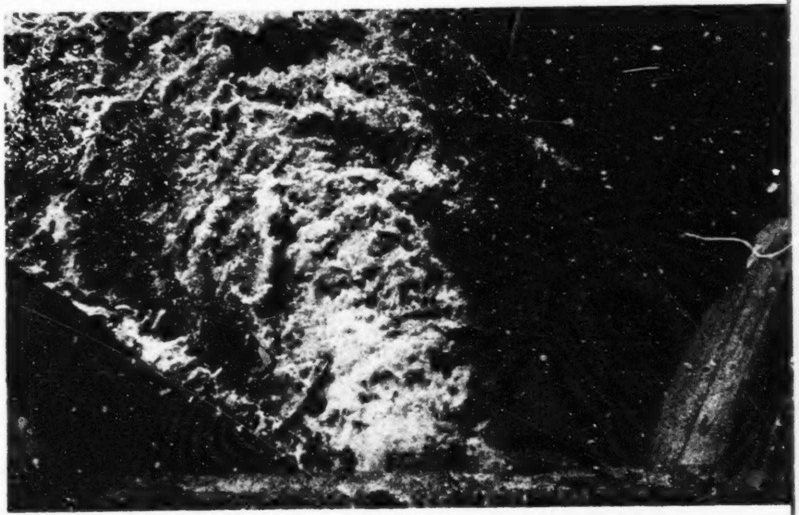
—Comprehensive river basinwide programs for pollution abatement must be developed, and new treatment works must fit in with such programs, as well as with metropolitan and regional plans, to be eligible for Federal aid.

—In evaluating new applications, the FWQA may demand detailed data on all sources of pollution in the entire river basin, including the volume of discharge from each source, character of effluent, present treatment, water quality effect and other items.

—If some industrial wastes are to be treated as part of a municipal system's operations, industry must pretreat those wastes if they would interfere with efficient operation of the community system. Further, a system of "cost recovery" must be required if some industrial wastes are to be treated in a new plant built with Federal aid. Such cost recovery by the municipality would assess the industries a share of the operating costs and costs of amortizing the debt, in proportion to their contributions to the cost of waste treatment.

—State water pollution control agencies must inspect new Federally-aided facilities for efficiency and economy at least once each year for the first three years of operation and periodically thereafter under standards set by FWQA.

—Design of any new Federally-aided treatment plant would have to be approved in advance as being economical, efficient, and effective under FWQA requirements.



Adequately treated sewage effluent pours into a river without harmful effects.

In addition to these changes in the substantive elements of the construction grants program, FWQA has established a study project to review grant procedures and to determine any changes necessary to streamline those procedures to assure efficient and effective grant administration. A task force including management consultants and FWQA personnel is in the process of preparing a report concerning needed improvements.

All together, the proposed legislation, the amended regulations and the continued efforts to streamline administrative procedures will result in an overall improvement of the construction grants program and will provide financial assistance to the Nation's communities, which will be fully adequate to meet the needs of the years ahead.

Assistance to Industry

With the acceleration of the Nation's cleanup program, industries are faced with major pollution control expenditures. Although there are no specific Federal assistance programs directly geared to provide funds for industrial waste treatment equivalent to the Federal assistance for construction of municipal treatment plants, there are several Federal incentive programs which provide encouragement and support for industries to meet their treatment requirements.

FWQA is encouraging and supporting the treatment of industrial wastes in municipal treatment plants; municipal systems designed to receive industrial wastes are eligible for support under the construction grants program.

The practice of treating industrial wastes in municipal treatment plants has a number of advantages. First and foremost, it provides for more effective pollution control by encouraging regionalization of the waste treatment system. A community that maintains effective treatment of its sanitary wastes can still be a polluter if industrial waste discharges from its borders are uncontrolled. Joint treatment is effective too because it locates responsibility for operation and maintenance within a single authority. In addition, complementary characteristics of sewage and industrial wastes, if properly controlled, can often permit more effective waste reduction within the plant.

Meat packing wastes discharged untreated into a river.

Joint treatment facilities offer significant advantages to both communities and industries in terms of lower treatment costs through economies of scale. The inclusion of industrial wastes in municipal plants also offers special incentives to industry, as these joint facilities can be built with the help of a Federal construction grant. Industry thus can pay for its waste treatment through operating costs, rather than having to make the extensive capital investment involved in the construction of treatment facilities.

Joint treatment of municipal and industrial wastes is increasing, as is the development of technology to handle a variety of complex wastes. For example, metropolitan Seattle has adopted an ambitious program to provide treatment for all liquid wastes that occur within its extended area of jurisdiction. More and more communities are designing their facilities to accommodate a larger portion of the total waste load that is produced by factories, with the cost of construction shared by the community, industry and the Federal, and sometimes State, government.

At the same time, as part of the overall reform of construction grants requirements, FWQA is moving to eliminate certain abuses of joint treatment and to ensure that municipal and industrial systems will operate effectively. First, through pretreatment requirements in the new regulations, the discharge of wastes which would make municipal systems nonoperative or reduce their effectiveness will be controlled. Second, industries are required to reimburse the municipality concerned for the added cost which treatment of their wastes imposes; this will ensure that the municipality will have sufficient revenues to provide adequate waste treatment on a continuing basis.

FWQA also provides assistance to industry through its research and development program. Since 1966, the Federal Water Pollution Control Act, as amended, has authorized grant support of industrial demonstration projects aimed at improving waste management. Although not intended as a direct form of assistance in defraying the costs of constructing waste treatment plants, projects supported by these grants have demonstrated methods of treating industrial wastes more economically and of recovering certain portions of wastes for reuse. Other grants have been used to show the feasibility of joint treatment of municipal and industrial wastes.

Tax write-offs provide further assistance to industry. Although a number of States have enacted tax measures designed to encourage industrial waste treatment facilities, until recently there was no comparable measure in effect at the Federal level. In enacting the Tax Reform Act of 1969, however, the Congress included provisions for accelerated amortization of air and water pollution control facilities for Federal income tax purposes.

Under this law, a taxpayer is entitled to a deduction with respect to the amortization of certified air and water pollution control facilities. A certified pollution control facility is defined as a new, identifiable treatment facility which is used, in connection with a plant or other property in operation before January 1, 1969, to abate or control water or atmospheric pollution or contamination by removing, altering, disposing, or storing of pollutants, contaminants, wastes, or heat . . . and which, in the case of water pollution control facilities, is certified by the State water pollution control agency as meeting State water pollution control requirements and by the Secretary of the Interior as meeting Federal water pollution control requirements. The Secretary may not certify facilities to the extent that the cost of such a facility will be recovered over its useful life.

Regulations are being prepared by the Department of the Interior and the Department of Health, Education, and Welfare in consultation with the Treasury Department to implement the Federal certifying responsibilities.

Assistance to State and Interstate Programs

State agencies are the first line of defense in the national water pollution control effort. Many States have been able to strengthen their pollution control programs to meet the growing problems thrust on them in the past several years. Others, however, have not had adequate laws and resources to do the job. Federal program grants are available to State and interstate agencies to help them bear the costs of needed preventive and control measures. These grants are intended as realistic incentives for the State and interstate agencies to expand and improve their programs.

The program started in 1957 with an annual authorization of $2 million. The annual figure has grown to $10 million today, and the State and interstate agency expenditures have increased more than six times during that same timeframe. Many of the States have substantially strengthened their programs. Funds have been used for employing needed technical personnel, for purchasing special laboratory and field equipment, for waste treatment plant inspection programs, for more aggressive enforcement of State laws, for expanded monitoring and surveillance programs, and for training.

Many States improved their programs in the last year by passing new laws or strengthening existing authorities to provide for a more vigorous clean-up effort. For example, in Oregon, water pollution control became part of a newly created Department of Environmental Quality. A feature of this new Department is its ability to conduct an extremely successful enforcement program. With this new authority, Oregon is carrying on an aggressive abatement program for both industrial and municipal waste sources.

Also in the Pacific Northwest, the State of Washington's 1969 Legislature inserted a requirement that after July, 1974, no applicant can receive a Federal construction grant unless the project conforms to a comprehensive drainage basin plan for water pollution control. This requirement places a burden of urgency upon the State to give planning a very high priority. This change is consistent in purpose with the Secretary's recent proposals for a more systematic and comprehensive administration of the construction grants program.

In Connecticut, legislation enacted during FY 1969 furthered the Connecticut Water Resources Commission's leadership role in several ways:

1. Bonding authorization for pollution control facilities, including pre-financing of Federal grants, was raised from $100 million to $250 million.

2. To promote regionalization, the Commission is authorized to issue orders to polluters jointly after a determination that such pollution can best be abated by the action of two or more adjacent municipalities.

3. New statutes were enacted, covering all phases of oil pollution removal and prevention and containing a provision for strict liability on spillage.

Two other highlights of State accomplishments in recent years are found in New York and Pennsylvania. New York provides reimbursement to municipalities for 1/3 of the cost of operation and maintenance of sewage treatment plants when they are operated according to established standards. Every municipal sewage treatment plant is comprehensively inspected at least once each year by a sanitary engineer and a chemist to evaluate operation and maintenance and laboratory work and to determine quality parameters for raw waste, treated effluent and receiving waters. In Pennsylvania, the Department of Health regulates and administers annual payments to municipalities of 2% of construction costs toward operation of sewage treatment facilities. About 685 applications are now being processed for payment of approximately $8.1 million in 1969. Payment is toward the operation, maintenance, repairs, replacements, and other expenses relating to sewage treatment plants.

New York and Pennsylvania are two of the States that have been fortunate enough to have the resources to support their water pollution control programs. In many States this is not the case, and it is perhaps here that the impact of Federal program grants is most significant.

As a basis for receiving a Federal program grant, each State and eligible interstate agency must prepare a plan describing how the grant will be used to strengthen its pollution control program. To assure the most effective utilization of these funds, the Federal Water Quality Administration (FWQA) has developed guidelines which set forth the essential elements of an effective State and interstate program plan.

In addition to constituting a request for grant assistance, the Program Plan serves several other important purposes.

1. It provides the State's annual report on progress in implementing water quality standards.

2. It provides information essential to FWQA in developing assistance and coordinating other grants to the State or interstate agency under other provisions of the Federal Act.

3. It identifies and discusses problems and issues in extending or improving the State or interstate agency's water pollution control program and helps in evaluation and program planning.

The FWQA has worked closely with the States in this planning process. Several Regional Offices have, in response to State requests, initiated joint review and evaluation studies of individual State programs. Last year such studies were completed in South Carolina and Idaho; additional studies are planned this year. Through these studies the Federal and State agencies work together in identifying problems and needs and in proposing action programs. As a result of the South Carolina study, the program was presented to the Governor and the legislature for consideration by the General Assembly. It is anticipated that these recommendations will result in additional staff and resources for South Carolina's program and in general provide an improved program for the State.

In order to provide maximum assistance to the States, a new approach for analyzing and evaluating the effectiveness of State program performance is being tested in cooperation with State water pollution control agencies. The proposed new system will be oriented to accommodate inclusion of such detailed information as necessary to permit an objective evaluation of program performance. The State program appraisal will form the basis for evaluating basic State program resources, such as State policy, legislative authority, rules and regulations, organization, staffing, and budget; performance in terms of resource utilization; and accomplishments, such as stream miles or estuarine acres brought into compliance with water quality standards.

In addition, the system will identify State program needs and translate those needs into priorities and objectives in pollution control. The apppraisal procedure will define and identify the minimum criteria governing Federal financial assistance to State programs. It will provide for a continuous review of State programs in order to enhance coordination of State and Federal activities and will permit relating accomplishments to established goals. Finally, the appraisal system will provide for a meaningful comparison of State program performance among States.

The FWQA is also supporting a number of special activities which demonstrate the utilization of advanced techniques by State and interstate agencies. For example, the agency is giving funds to Pennsylvania to help develop a Statewide pollution information system designed to handle all water quality data. This system will provide a modern management tool to help the State systematically administer its program. A modern, automatic monitoring system of water quality parameters and the telecommunicating of information to a central processing location have been expanded by the Ohio River Valley Water Sanitation Commission using FWQA support.

The accelerated drive for clean water stemming from strengthened Federal regulatory and financing programs will also demand an increased capability on the part of the water pollution control agencies of many States.For this reason, proposed legislation to provide additional grants to State and interstate agencies is an important element of the Administration's program. The new legislation would increase the authorization each year on a sliding scale from $12.5 million for fiscal year 1971 up to $30 million for fiscal year 1975. Emphasis would be placed on development, performance, and substantial improvements to State programs. The basic grant program contained in the present Act would remain, but three new categories of grants would be authorized: program development grants, program improvement grants, and special project grants.

The new amendments are essential to increase support to States and interstate agencies to enable them to carry out and accelerate programs of water quality standards enforcement and implementation, the implementation of the Department's proposed construction grant requirements, and the accelerated construction of needed treatment facilities.

From both a long and short-range viewpoint, the State program grants are a good investment. National pollution control efforts can move ahead only as fast as the State and interstate agencies respond with imaginative and thorough programs to meet their responsibilities.

Technical Assistance

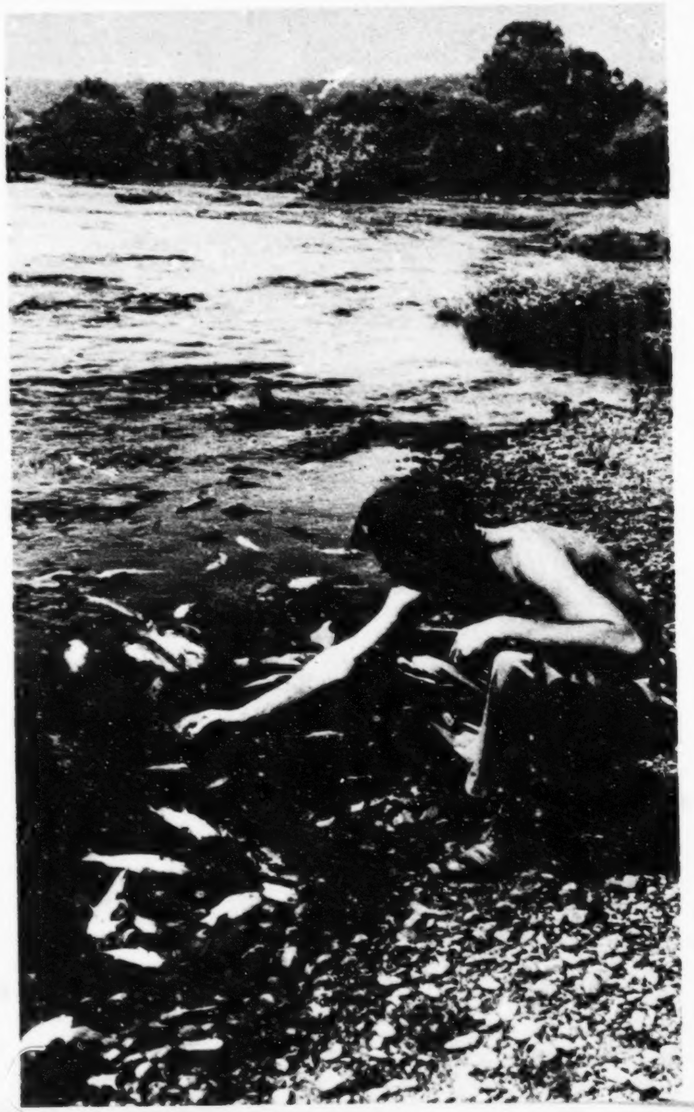
Technical assistance is another key program available to help States solve pollution problems. A great many of the water pollution problems facing the Nation call for technical study to determine the sources or causes of the pollution and to find the most appropriate abatement measures to remedy the situation. Often, the problem is complex and requires extensive field and laboratory study. Acid mine drainage, coastal and estuarine pollution, groundwater contamination, and pesticide and toxic chemical pollution are examples of pollution problems for which the most effective and appropriate corrective action is frequently unknown and for which specific technical study is necessary before abatement action can be pursued.

Federal Water Quality Administration (FWQA) assists the State and interstate water pollution control agencies in developing their technical capabilities and provides financial assistance for this purpose through the program grants previously described. These agencies conduct a great many of the technical investigations required to carry out an effective water pollution control program, but frequently they find it necessary to call for outside assistance to handle problems which exceed their capabilities. To meet these needs FWQA provides technical assistance of various kinds ranging from technical advice and consultation to extensive, long-term field and laboratory studies. Within the limits of available resources, this assistance is provided on request, primarily to the State and interstate water pollution control agencies, but also to other public agencies, including other Federal agencies.

During 1969, FWQA responded to over 300 major requests for technical assistance and numerous requests for advice, information, reviews and comments on technical problems. The following examples will serve to illustrate the program:

During the last quarter of 1969, FWQA conducted intensive water quality and waste source surveys on Perdido and Escambia Bays and tributary river basins. The study on Perdido Bay was requested by the State of Alabama to determine the cause of the declining fishery and of the occurrence of unsightly brown foam in many parts of the Bay. The work on Escambia Bay was made in response to a request by the State of Florida to determine the cause of the dozen or more fish kills that occurred in the Bay during the summer of 1969. Both studies identified offending waste sources and the remedial measures required. Upon completion of the two studies, the respective State governors re-

FWQA provides technical assistance to States to help solve difficult pollution problems, such as fish kills.



quested Federal enforcement action, and, in response, enforcement conferences were held early this year. These resulted in specific abatement recommendations and time schedules. The State of Florida has begun implementing these recommendations through the issuance of clean-up orders, and FWQA is continuing to provide technical assistance and support for these efforts.

In other cases, States have applied the findings of FWQA technical assistance directly under their own authorities. The water quality study of Hillsborough Bay, Florida, which was completed in 1969, is a good example. This study was addressed to a long-standing obnoxious odor problem resulting from the death and decay of marine algae. Discharges of municipal wastes from the City of Tampa and industrial wastes from several chemical and fertilizer plants were shown to be adding sufficient nutrients to the Bay to cause the enhanced growth of marine algae. The cause of the massive amounts of dead and decaying algae giving rise to the odor problem was thus traced back to the waste discharges. Other aspects of water quality degradation were also identified together with their causes. The findings of the study were presented in a public hearing held by Florida Air and Water Pollution Control Board in February of this year. The abatement recommendations of the study report were adopted, and the State agency has begun issuing implementation directives. The affected companies, the City of Tampa and the other local agencies have initiated the planning of remedial facilities and practices, thus demonstrating positive follow-through action based on FWQA's technical assistance study.

Another recent example of technical assistance is a field investigation of the James River below Springfield, Missouri, completed last year. This study was conducted in response to a request from the State of Missouri and was aimed at determining the causes of and corrective measures for the severe water pollution and frequent fish kills occurring in the River below Springfield. Several waste sources were identified as the cause of the problem, and abatement measures to be taken by these sources were recommended. On the basis of these findings, the State and the polluters have initiated remedial actions, some of which have been completed, and significant improvements in water quality have already been achieved.

To aid the State of Wyoming in assessing the pollutional impact of a uranium mining operation on Little Medicine Bow River, FWQA developed a radiological monitoring network and schedule for the State and performed the radio-analysis on the samples collected by the State during the summer of 1969. Radio-analysis assistance will be given again in 1970. The State intends to use the data collected to determine the need for waste treatment or control by the mining operation. This exemplifies a type of assistance widely provided by FWQA—the performance of complex analytical and bioassay tests, such as those for pesticides, organic chemicals, heavy metals, various toxicants and radionuclides.

As these examples illustrate, most of FWQA's technical assistance is devoted to investigating specific problems and finding the appropriate available corrective measures. These studies are not directed to research or development of new and improved technology; however, in some cases these studies indicate that corrective measures are not apparent. Thus fruitful topics for research are often identified and these are referred to FWQA's research and development program for follow-up.

To carry out its technical assistance activities, FWQA relies on the basic staffs of engineering, scientific and technical personnel and support laboratory facilities and equipment in each of its nine Regions. Each Region is equipped to conduct intensive field studies involving chemical, biological, microbiological, hydrologic and other disciplines. The coastal Regions are equipped to undertake oceanographic investigations in addition to other types, and the Great Lakes Region has special capabilities for performing lake investigations.

Requests for technical assistance can be expected to continue to rise in the future, despite the expanding capability of many State pollution agencies. The problem areas of subsurface and ocean waste disposal; pesticide and radiological pollution; animal feedlot, sediments, salinity and other aspects of agricultural pollution; and the complex interacting problems of environmental quality protection will require much greater attention than they have had to date. For many individual States these problems do not occur frequently enough to justify maintenance of special skills and equipment on a permanent basis. However, they arise often enough across the country to warrant attention at the national level, and the experience gained in solving pollution problems in one part of the country can be useful in dealing with similar problems elsewhere. FWQA is prepared to give continuing help to State, interstate, and local agencies so they can carry out their remedial programs.

PLANNING AND BASIC STUDIES

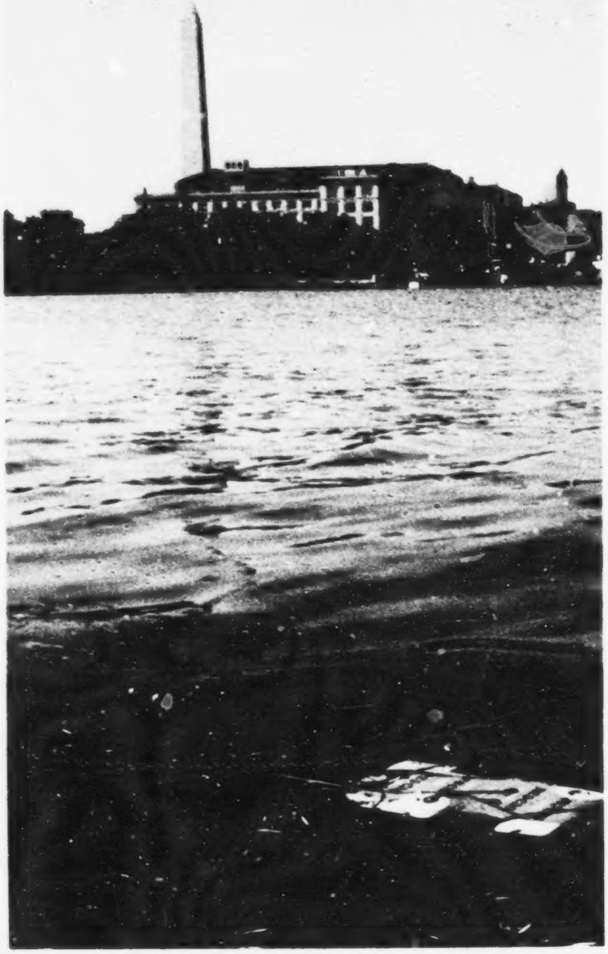
Just as any structure needs a good foundation, the nationwide effort to control pollution requires a variety of supporting programs to provide a sound basis for action. These basic support programs help to ensure that our action programs are soundly conceived and will yield clean water results adequate to meet present and future needs. Planning, data systems, and economic studies, all play a supporting role in the battle for clean water.

Need for such basic underpinning is clearly illustrated in the problem of assuring adequate environmental protection in connection with location of major electric power generating facilities. Strengthened procedures authorized by the Water Quality Improvement Act of 1970 to ensure that Federally-licensed power plants will meet water quality standards have been discussed. Although these procedures only apply to one aspect of the environmental impact of power production, they represent major progress.

So long as such review takes place relatively late in the process of designing a plant, however, it cannot be fully effective. There is still a major need—recognized both by the Federal government and by enlightened sectors of the electric utility industry—to provide for consideration of environmental factors in the early stages of site selection. More effective means of planning must be found, which will provide the public with full assurance of environmental protection, and which will enable the utility industry to meet growing power needs without confusion and serious last-minute delay.

The Federal Water Quality Administration (FWQA) and other Federal agencies with an interest in the development or regulation of electric power have been working with the Office of Science and Technology on a comprehensive study and evaluation of power plant siting. In December, 1968, a report, *Considerations Affecting Steam Power Plant Site Selection*, was published. Since that time, the above agencies have been giving attention to the appropriate roles of the Federal, State and other public agencies in the regulation of power plant site planning.

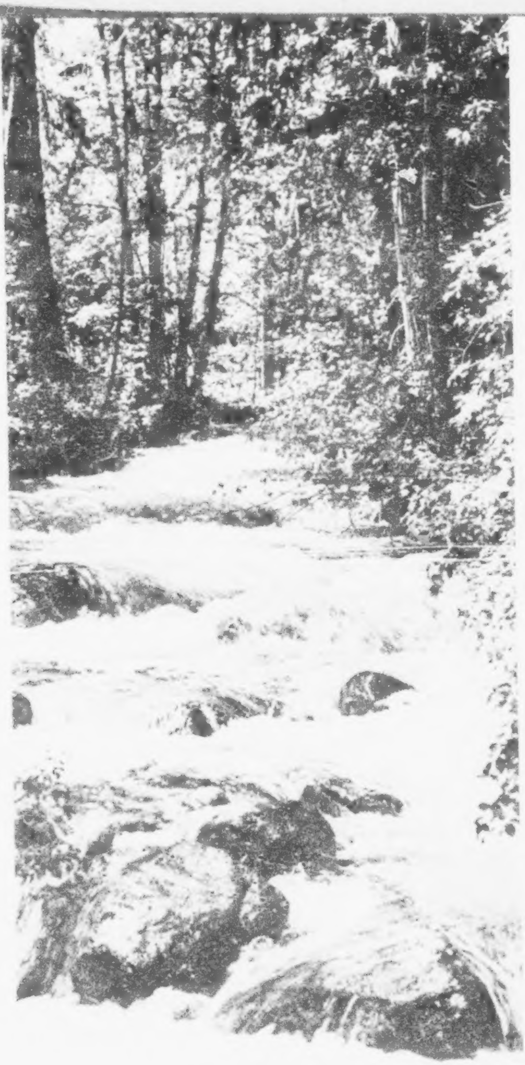
At the Regional level, FWQA is participating with the New England River Basins Commission (NERBC) in developing criteria for siting power plants for New England. The NERBC power/environment program got off to a positive start in late 1969 with an in-depth look at the environmental impact of the proposed Seabrook nuclear power plant site in New Hampshire. FWQA assisted in preparing the water quality impact section of the study. The Agency is participating in a similar activity in the Columbia River Basin.



Flowing past the Nation's capital, the Potomac River typifies the need for regional and basinwide planning.

Environmental Planning

Although a major part, water pollution control is but one facet of the overall program for preserving and enhancing our environment. One of the most significant occurrences during the past year has been the greatly increased awareness on the part of public officials and citizens of the interrelationships among programs to clean up air and water pollution, to manage solid wastes and conserve natural resources, and to provide parks and increased recreational opportunities.



Taking a clean environment for granted has led to wasteful spoilage. Planning helps both to preserve and to recover our natural resources.

To focus on major environmental issues that may involve actions of a number of interrelated Federal, State and local agencies, President Nixon established on May 29, 1969, a Council on Environmental Quality comprised of Federal Cabinet officers and Citizens' Advisory Committee. Subsequently, the Congress enacted legislation giving comprehensive expression to these concerns—the National Environmental Policy Act of 1969. This Act authorized a new Council on Environmental Quality, whose members have been recently appointed, and the former Council has been redesignated the Cabinet Committee on the Environment. The Environmental Quality Improvement Act of 1970, just recently enacted, further provides for the establishment of an Office of Environmental Quality to serve as staff to the Council.

To strengthen its capability in environmental planning and to provide a focus for coordination with the new Council, as well as with other agencies, the FWQA is establishing an Office of Environmental and Program Planning.

Environmental planning concepts, with the emphasis on long-range consideration of the effects of certain waste disposal practices, and the realization that site location practices are as vital as pollution control facilities, are increasingly incorporated in the policies and activities of a number of FWQA programs. Through effective participation in environmental planning, FWQA can best come to grips with such difficult pollution issues as thermal pollution control, including the previously discussed need for better selection of sites for power generation facilities to protect environmental values; protection of groundwaters and control of underground disposal methods; reducing the impact on waters of salinity resulting from irrigation practices and water development projects; location of oil refineries and future offshore loading facilities relating to the prevention and control of oil pollution; and decreased use of phosphates in detergents.

Other needs that have been identified include development of criteria for evaluating potential airport and highway sites; studying ways in which FWQA could help improve Federal, State and local mechanisms for land-use planning, particularly in critical estuarine areas; and ways in which marshlands could be protected from indiscriminate filling and development.

Development of policies on waste handling and treatment to avoid water pollution must be carried out with the realization that, ultimately, effective waste disposal must involve integrated consideration of air and water pollution control and solid waste management. Water pollution control policies must avoid creating air pollution or solid waste problems and seek, instead, ways of combining methods for maximum reduction of waste loads. Further emphasis must be placed on effective waste management through recycling, recovery and reuse of the by-products of our technology.

Continued thought and effort must be placed on developing means of making so-called "technology assessment"—identifying the possible environmental consequences of new technology before they become widespread problems to be cured after the fact. A major challenge is finding the means whereby we will not have to wait until products, such as the phosphate-based detergents or hard pesticides, become a cause for major concern before we turn our attention to safeguards or substitute methods.

To improve the system for identifying potential or existing environmental problems, Secretary Hickel established an "Environmental Early Warning System" in the Department, clarifying the channels through which any member of the Department can highlight situations that need attention from government. FWQA has established coordinating mechanisms to work with this System and thus far has participated in studies of a number of issues.

FWQA is actively cooperating with the Forest Service and Bureau of Outdoor Recreation in evaluating a number of rivers for inclusion in the National Wild and Scenic Rivers System. This System affords a mechanism for protecting waters of unusually high quality or scenic value from degradation. Some rivers have already been designated for inclusion in the System, and measures for protecting the quality of these rivers will involve both FWQA and the State water pollution control agencies, as well as the Federal agencies which have been designated to administer these areas (Bureau of Land Management, National Park Service, Forest Service).

During the past year, FWQA has participated actively in several interagency planning efforts aimed at studying the impact of development on several areas and seeking measures to mitigate the effects of that development on the environment. One of the most significant involved plans for large-scale development of petroleum resources on the North Slope of Alaska. FWQA made significant input into establishment of guidelines on practices which the oil companies would have to use in construction of facilities, in use of pipelines and other means for transporting the oil, and in carrying out production, so that the resource could be developed without severely damaging the environment, particularly the sensitive and complex tundra areas.

Other issues have involved industrial and housing development in areas along the Eastern Coast. There is increasing realization that the harmful effects of poorly located developments on the quality of coastal waters; on sensitive aquatic resources, such as shellfish; and on marshlands and beaches are too high a price to pay for short-term economic gains in coastal areas, and that many of these effects could be avoided by better consideration of alternative locations and methods of waste handling. In one case, serious shortcomings with the location of an oil refinery near the Chesapeake Bay were brought to light in FWQA investigations, and the company subsequently changed its development plans.

A case currently being studied involves the location of a chemical complex on the South Carolina coast in an area of extremely high natural and recreational value. A German chemical company, BASF, purchased land near Hilton Head, South Carolina, to construct a large petrochemical plant; this project has received nationwide attention and has caused considerable concern to environmental agencies. After reviewing the company's proposal and the conditions of the area, Secretary Hickel wrote to BASF on March 24, 1970, to express his concern that waste discharges from such a plant or transportation of materials might damage the high quality waters and the shellfishery which are now protected by Federal-State water quality standards, and that dredging of any navigation channels would destroy very valuable aquatic habitat. He stated that the Department would oppose any action which would result in degradation of that water quality and would oppose any proposal for channel dredging which would cause environmental damage. Subsequently, on April 7, 1970, BASF announced suspension of its plans pending further consideration of necessary measures to avoid these damages.

These and other issues point strongly to the need for better ways of assessing public values and of planning development in consonance with protecting the environment.

The Big Cypress Swamp is another significant issue where FWQA resources are being used in conjunction with those of other agencies to protect an area faced with development. This swamp is a vital source of water for the Ever-

Economic development and preservation of natural resources, such as Big Cypress Swamp, must be reconciled through environmental planning.

glades National Park, and both the Everglades and Big Cypress form a unique and very valuable natural resource. Proposed construction of a jetport in the swamp has been halted; however, the larger challenge of controlling development in South Florida and providing needed facilities for a rapidly growing population and economy while still protecting the Florida environment is just beginning to be faced by a variety of Federal, State and local agencies. In a sense, South Florida is an early and compelling example of conflicts on the use of resources which we may face in many parts of the Nation before long. The beautiful Florida environment has attracted the very forces that endanger the survival of that environment, and that survival must depend, it appears, on effective long-range planning and control of development.

The above examples have concerned areas where development is threatening a high quality environment. Some of the greatest challenges and potential rewards for water pollution control are also in areas which have been degraded and where pollution clean-up may bring great recreational and other opportunities. This is particularly the case in increasing the opportunities for inner-city residents to swim, fish, picnic and enjoy the outdoors in urban areas. For example, FWQA assisted the National Park Service and Bureau of Outdoor Recreation in planning for the proposed Gateway National Recreational Area near New York City. Full use and enjoyment of this area will depend on effective pollution control.

Other proposals of this kind have been or will be increasingly explored. One FWQA research plan is to clean up pollution from combined sewers discharging to the Anacostia River within Washington, D.C., and develop a large inner-city swimming and boating area. Yet another approach—Project Cure, developed jointly by FWQA and the Bureau of Outdoor Recreation—is being considered for application in some areas, based on experience in Santee, California, with total wastewater renovation and use of the treated wastewater for recreation. One of the features of the Santee project is a series of five lakes which have been created below the treatment plant and filled with essentially pure effluent. Because of the high quality of treated wastewaters, these lakes are used for a host of recreational activities such as boating, fishing, and picnicking.

Basin and Regional Planning

Basin and regional planning is an essential element in pollution control. As President Nixon has pointed out: "A river cannot be polluted on its left bank and clean on its right. In a given waterway, abating *some* of the pollution is often little better than doing nothing at all, and money spent on such partial efforts is

The Santee Project in California renovates wastewaters and provides reuse through recreational lakes.

largely wasted." Clean water results will only be achieved by systematically controlling pollution in entire river basins. Further, we must be sure that these results are lasting ones, that our actions today are adequate to meet the needs of the future, and that we make provision for future growth of waste loads, population, industry, and water use. Otherwise, these future developments may more than offset any gains that our action programs in the years immediately ahead will achieve.

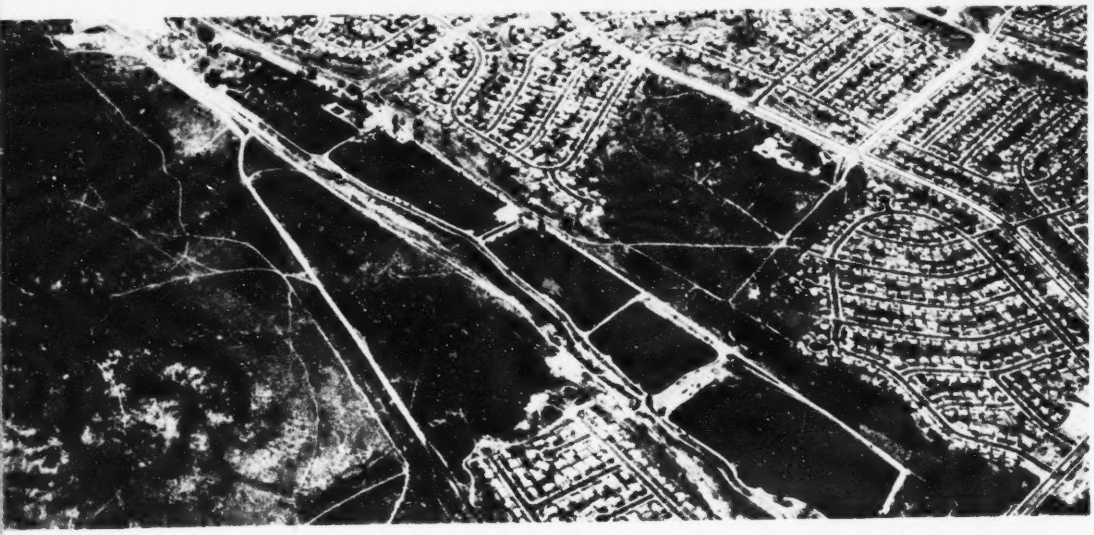
For these reasons, planning is an important element of the FWQA program. FWQA is participating in basin and regional planning in cooperation with State and other Federal agencies and is financially supporting regional planning activities at the State and local level.

The long-term impact of river basin development will be a major factor in keeping the Nation's rivers clean and useful. Changes in stream flows cause temperature increases and other water quality effects. Sustained stream flows are essential for maintaining water quality even where a high degree of treatment is practiced. Irrigation diversion and other developments often deplete these needed flows and return them in lesser quantity and quality.

A major part of the planning responsibility is to ensure that water pollution control and water quality are adequately considered in all Federal water resource development activities, such as planning or construction of reservoirs or irrigation projects. FWQA is participating in broad-scale water resource planning in association with other Federal and State water resources agencies in basin planning studies coordinated by the Water Resources Council. These interagency studies result in comprehensive water and land related resource plans, laying out a future framework for river basin development. These plans are presented by the Water Resources Council to the President and the Congress to be considered in authorizing Federal water resource development projects. FWQA participates in these framework studies to ensure that water pollution control is an integral part of the development and management of the Nation's waters.

Last year, for example, a study of the White River in Arkansas and Missouri completed under this program provided for an intensive program of development and management of water and land resources while emphasizing the continued protection and enhancement of the environment. The plan provides for the cleanup of polluted sections of the River and the maintenance of other sections at their present high quality. In addition to specific treatment facilities at present and anticipated waste sources, the plan provides for the inclusion of storage in specific Federal reservoirs to regulate stream flows to assist in the maintenance of water quality.

In addition to participation in these framework studies, FWQA is involved in a number of more specific water resource planning activities. In the Central Valley of California, where agricultural development threatens water quality in San Francisco Bay and the San Joaquin Delta, FWQA is participating with the Corps of Engineers and the Bureau of Reclamation in long-range planning studies to determine the overall regional impact of continued water development on the environment and the necessary measures to ensure protection of future quality over the long run. In the Delaware



River Basin, FWQA has participated with the Delaware River Basin Commission in the development of a plan and program for the use and upgrading of the highly polluted Delaware estuary. This program has involved the development and utilization of pioneering systems analysis techniques to model the Delaware and show the most effective and systematic approach to achieving improved water quality.

In addition to its basinwide resources planning activities, FWQA reviews proposed water resource projects on an individual basis to ensure that these projects do not have an adverse effect on water quality and that, when it can contribute to the economical control of pollution, storage for water quality is included in Federal reservoirs. As an example, plans for a Federally-assisted project on the Alcovy River, Georgia, were changed considerably after it was shown that the removal of vegetation along the stream channel would adversely affect water quality and be detrimental to fish and wildlife. Revisions made will result in maintaining much of the stream channel and its present cover, greatly reducing the amount of dredging and providing additional safeguards to minimize the removal of vegetation along the river bank.

FWQA also makes recommendations to Federal construction agencies for inclusion of storage for water quality management in proposed projects. Higher sustained streamflows are sometimes needed, in addition to adequate treatment of wastes and other controls, to meet water quality standards.

River basin planning can yield important results in developing solutions to complex pollution problems that must be dealt with along the lines of entire basins and that cannot be solved without a coordinated effort by all parties involved. The information collected and the plans developed under this program have served as a springboard for a number of State clean-up programs. For example, a mine drainage study conducted as part of a comprehensive water pollution planning effort in the Pennsylvania portion of the Susquehanna River Basin has resulted in a substantial State program to abate mine drainage pollution. The study resulted in the locating of over 1,000 mine drainage discharges causing gross water quality degradation in 1,200 miles of stream. It was found that restoration of streams polluted with mine drainage could be accomplished through a program which included mine sealing, neutralization, land treatment, and water regulation and diversion. Selective implementation of action called for by the water quality management study is underway with the aid of a conservation bond issue adopted by the Pennsylvania legislature which provides $150,000,000 for the reclamation of areas disturbed by mining and the abatement of mine drainage pollution.

In addition to direct planning activities, FWQA is supporting regional planning through grants to planning agencies at the State and local level. These grants are designed to stimulate the kind of State and local planning which is important to the implementation and improvement of water quality standards along river basin lines. This program was initiated in 1967, and 12 studies are underway with total Federal costs of over $2.5 million. The Federal share is limited to 50 percent of the costs of developing the plan. These grants afford agencies at the State and local level a unique opportunity to participate in solving their pollution problems on a coordinated, long-range basis.

Under this program, the Santa Anna Watershed Planning Agency in California is developing a pollution control plan which will provide for eventual reuse of the reclaimed water. In this watershed, available surface water flows are almost completely developed and large quantities of Colorado River water are being imported. In areas near the coast, because of heavy pumping, groundwaters are threatened by salt water intrusion. The plan being developed will consider both surface and groundwaters and provides for pollution control and wastewater reclamation and reuse as an integral part of the water supply program in the watershed.

The Miami Conservancy District in Ohio is also conducting a planning study partially funded by an FWQA planning grant. The study is utilizing an extremely sophisticated systems analysis technique to relate water quality, flood control, and other factors involved in water quality management decisions in the basin. The plan will consider the whole range of effects on water quality of such alternatives as in-stream aeration, use of abundant groundwater supplies to augment streamflow, and the regionalization of waste treatment facilities.

FWQA is also assisting a planning effort in Puerto Rico. The Commonwealth planning is aimed at developing programs to encourage industrial growth while maintaining and enhancing water quality. The Island's development has centered around the recreation industry for which water quality is obviously vital. The plan will provide for the protection of these recreational amenities in the face of future industrial development.

The emphasis in the President's environmental message and Secretary Hickel's recently published regulations on conformance of waste treatment plant construction with basin programs and regional planning to ensure speedy and coordinated pollution abatement will require increased emphasis on the part of FWQA on implementing effective short-term planning and appraisals. The new regulations will require that, within a river basin, each treatment facility be part of a basinwide plan for pollution abatement and within a given city, each treatment plant be included in a metropolitan or regional waste treatment plan. The Agency's planners are developing a procedure to evaluate grant applications to help the States meet the requirements of the regulations and to better integrate planning and facilities construction, so that in the near future planning can be used to efficiently and effectively guide waste treatment installation. This will place additional and immediate demands on FWQA's planning capacity.

Towards this end, FWQA is increasing the emphasis upon quick appraisals of the status of comprehensive and coordinated programs in each river basin and preparing to make quick evaluations of the adequacy of and need for planning within metropolitan areas. In the latter regard, FWQA is working with the Department of Housing and Urban Development. Last year FWQA's Northeast Regional office, working with Housing and Urban Development, developed a joint set of comprehensive guidelines for regional sewerage systems. These guidelines can be used in preparing plans for metropolitan sewerage systems and are sanctioned by both Housing and Urban Development and the FWQA.

To assist in basin and regional planning, FWQA has developed a highly sophisticated systems analysis capability. Models have been developed to show the relationships between various stream flows, waste loads, water uses, and other factors that influence water quality. These models can handle up to fifteen sections of stream, fifteen reservoirs, ten discharge points and natural pollutants. Although relatively new, these models have been used successfully on the Sabine River, Texas; Skunk River, Iowa; Scioto River; Ohio; James River, Virginia; Broud River, South Carolina, and many others. For a given river basin, the models can provide information to determine how management practices influence water quality and what changes in management could be expected to provide a certain water quality and the cost of that quality.

Models have also been developed for the Delaware Estuary, and these are now being applied to the Potomac River–Chesapeake Bay system. These models help to relate tidal effects to water pollution. The Delaware model has provided a tool for determining the needed releases from upstream to protect Philadelphia's water intake from excessive salinity intrusion during periods of drought.

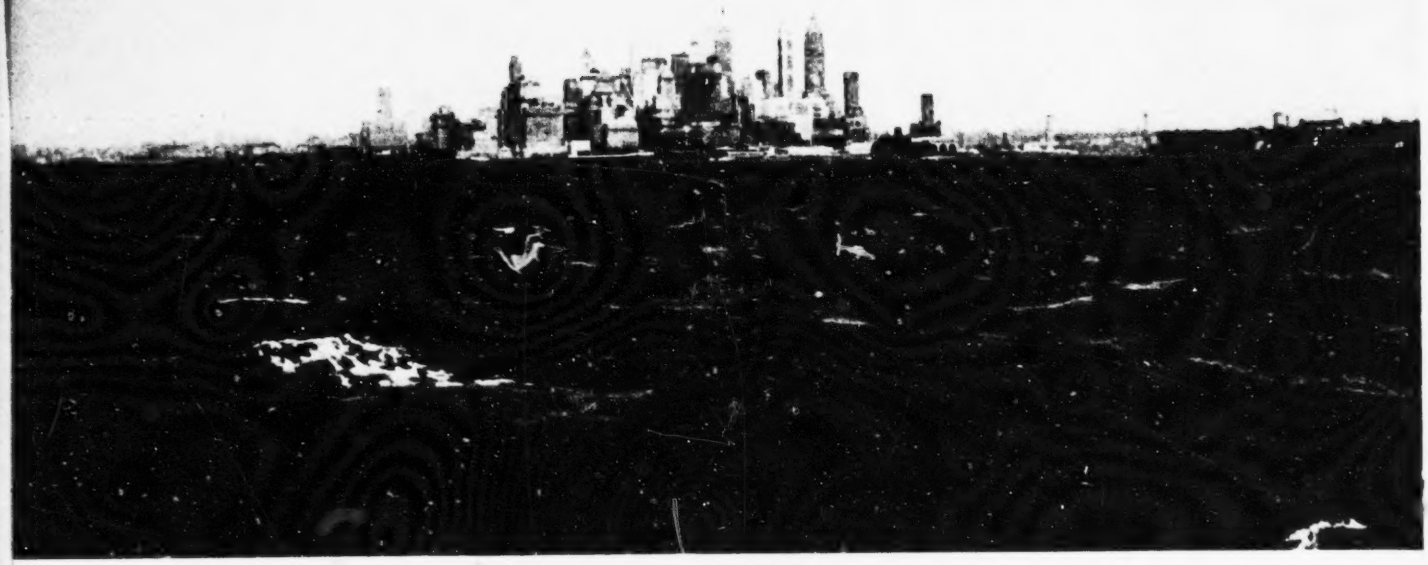
Another systems technique was applied in the San Joaquin Master Drain study in California. Here the model required inclusion of economic information, as well as the waste sources. The model provided the basis of measuring the impact of planned water resource development on an inland agricultural area, as well as on San Francisco Bay. Of major concern was the impact of pesticides and nutrients resulting from agricultural drainage. Through the use of this model, alternative locations of the drain outfall with consequent economic costs were determined, as were the costs of alternative treatment measures.

As planning for basinwide pollution abatement and regional waste treatment moves ahead in the future, the systems capability developed by FWQA will become increasingly important in the Nation's battle to achieve clean water.

Estuarine and Coastal Studies

For well over three and a half centuries, the estuarine and coastal waters of our Nation were thought of primarily as conveniences—places for the conduct of international commerce, locations for the residential and industrial development that resulted in our great cities, sites for mineral exploitation, and dumps for all kinds of wastes. Although this thinking is still commonplace, times are changing, and more and more people are becoming increasingly aware of the necessity to change our behavior with regard to these waters. We can no longer afford to treat our estuaries and the coastal waters over our Continental Shelf as endless sewers.

Because estuarine and Continental Shelf waters are so closely interrelated, pollution in one zone will affect the other. For example, hard pesticides, which are carried down rivers from the agricultural uplands and tend to accumulate in waters near the mouths of rivers, eventually spread into the surrounding oceanic waters. Conversely, an oil spill caused by the breakup of a tanker at sea will ultimately spread to the coastline, there to foul beaches and kill wildlife and waterfowl. Modification of the shoreline by dredging and filling will have an effect on life far out to sea. Ocean outfalls, while disposing of wastes at a distance from shore, are fre-



The polluted waters of upper New York Bay form the foreground for this view of Manhattan. Ocean outfalls and dumping of solid wastes imperil the fish and bottom fauna of these and other marine waters.

quently responsible for water conditions which make a shoreline area unfit for swimming or shellfishing. Sludge and solid wastes that are barged out to sea for dumping can return to shore on the currents and tides. Continental Shelf mineral development—ever increasing in importance—has the potential for major environmental damage.

The condition of the New York Bight area is a startling illustration of disposal wastes into coastal and ocean waters. The dumping of wastes near the New Jersey coast has recently come to the attention of a shocked public. Sewage sludge, treated and untreated, and various industrial wastes are a primary concern. A dumping area of approximately 14 square miles has been damaged and its bottom fauna severely impoverished. Even several species normally tolerant to pollution are absent from this area and evidence of pollution has been found on nearby beaches.

Not far away in the New York Harbor area, an outbreak of fish diseases has occurred over a three-year period. Large numbers of fish have neither tails nor fins, and there is some evidence that pollution may be at least partially responsible. Fish kills in the area are numerous, and there is growing concern about the contamination of shellfish—a threat both to the harvesting industry and to public health.

Federal Water Quality Administration (FWQA) over the last several years has strengthened its various programs, giving increasing emphasis to estuarine and coastal pollution. Increased enforcement activity along the coast—such as the recent conferences in Biscayne and Mobile Bays—has already been highlighted. Added emphasis is being given to oil clean-up activities. FWQA is now accelerating its work with the Coast Guard to prepare plans for a more speedy reaction to oil pollution incidents. Research and training programs that have a relationship to estuarine and coastal problems have also been increased. More emphasis is being given to studying pollution effects and ecological damages in the estuaries. More research chemists and marine biologists are being trained in FWQA-funded programs.

Because of the long-term cumulative impacts on the estuaries and coastal environment and because of the many interrelated actions affecting these waters—dredging and filling of marshes and construction of navigation facilities—considerable emphasis must be given to the overall planning and management of this valuable environment. Planning to protect our estuaries and coastal waters is a clear-cut example of the pressing need for environmental planning described previously.

As a result of increased public awareness of estuarine and coastal pollution problems, the Congress directed that a survey of estuarine pollution be made. FWQA, in November, 1969, submitted the report of this first comprehensive, definitive study of estuarine pollution to the Congress. With this report, the *National Estuarine Pollution Study*, proposed legislation for a comprehensive national management program for the estuaries and coastal zones, based on the report's recommendations, was submitted to the Congress.

The Study sought to obtain detailed information on the biophysicial, socio-economic, and institutional aspects of estuaries from a variety of sources. First, a series of 30 public meetings was held in the various coastal States to obtain information and opinion from the local citizens who are most directly affected by estuarine pollution. Second, information was collected from the coastal States concerning their laws and programs affecting estuarine uses and management. Third, studies were contracted to provide needed background on certain aspects of specific estuaries or on a restricted aspect of the Nation's estuarine areas. These include studies on ecology, economic and social values, sedimentation, and law. Reports on some of these studies are being published as the *Estuarine Pollution Study Series*. The first of these is entitled, *Legal Perspectives of Chesapeake Bay*. Others to be published will include *A Socio-economic Analysis of Narranganset Bay*, and *The Social and Economic Values of Estuaries*.

A major part of the study was the development of the National Estuarine Inventory, an automated information system. This massive compilation of coastal zone information is the basis for the development of a continuing national Coastal Zone Management Information System to satisfy the information requirements of States, Federal agencies, and other entities for factual data on which to make decisions.

The recommendations which were presented in the Study were predicated upon the concept that the States should have the major responsibility for managing the estuarine and coastal zones and that the Federal role should be to provide coordination of the State programs within the national plan, to provide technical and financial assistance to the States and their subdivisions and to arbitrate conflicts between States.

Legislation to promote these aims is presently being considered by the Congress. The bill, if enacted, will provide for Federal grant support of State management programs. The prime objective will be the management of the estuarine zones in such a way as to permit maximum beneficial use with minimum damage.

Closely related to the National Estuarine Pollution Study (NEPS), the Fish and Wildlife Service has recently completed the *National Estuary Study* (NES). This study involved an intensive look at fish, wildlife, and recreational values of the coastal zone for the purpose of recommending a scheme for protection of extremely valuable areas. FWQA assisted in this latter study by making the data bank of NEPS available to the Fish and Wildlife Service as its base source of information. The NES is a complementary effort to FWQA's broader study of man's activities in the coastal zone and how pollution from these activities causes environmental damage to coastal resources.

FWQA has also sponsored a major study, conducted by the National Academy of Science and the National Academy of Engineering, to determine the state of knowledge on ocean waste disposal. The findings of the study are being used to help formulate approaches to the problem. A report—*Wastes Management Concepts for the Coastal Zone*—will be published later this year.

FWQA will continue to conduct and fund studies to increase our knowledge of the estuaries, their resources, the damages done to them by pollution, and their relationships to the surrounding land. In addition, direct technical and financial assistance will be provided to States for management and improvement of their estuaries.

Data and Information

Effective implementation and enforcement of water quality standards, development of regional and basin plans, administration of grants, and preparation of reports assessing costs of pollution control and abatement progress require up-to-date, accurate fact-finding and readily available data.

Several types of technical information are required to meet the various needs: specific data covering the status and effectiveness of municipal, industrial and Federal waste treatment and control facilities; current economic data associated with construction activities; and water quality data related to the water quality standards.

Collection, evaluation, and dissemination of data on chemical, physical, and biological water quality and other information relating to water pollution discharges is an essential element of the Federal Water Quality Administration (FWQA) program. Through effective coordination with other Federal and State agencies, such data and information are utilized at the national, regional and basin levels.

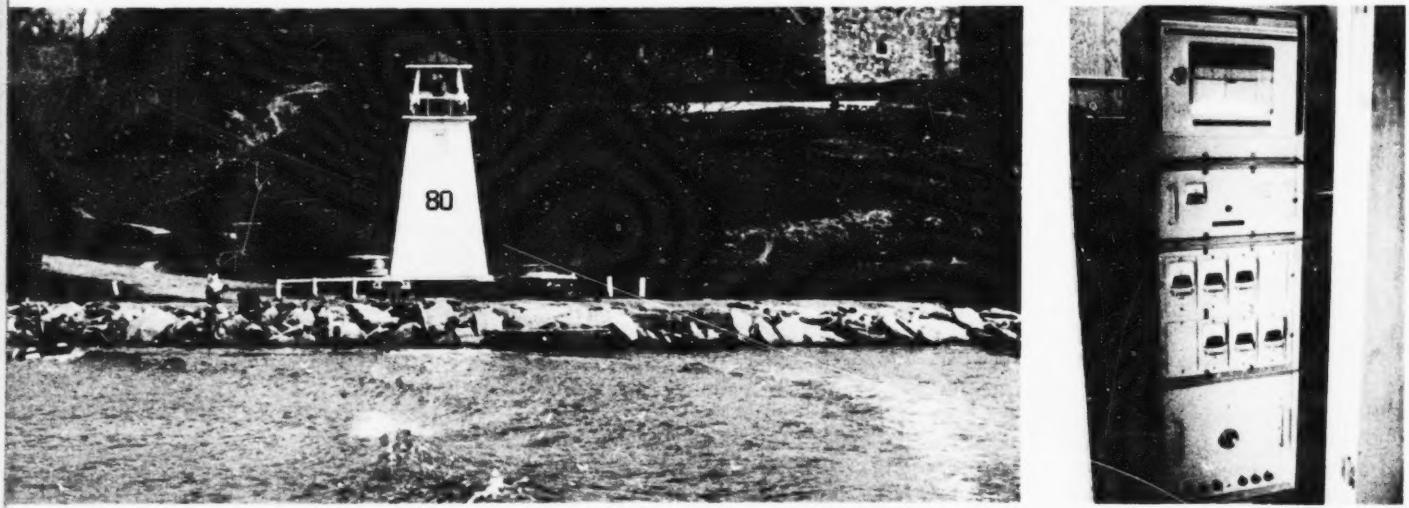
Collection and timely evaluation of reliable information on water quality is vital to the effective management of a dynamic national pollution control program. This has always been a requirement, but the need has intensified with the establishment and implementation of water quality standards and the resulting necessity of identifying priorities in waste treatment facility construction. Regardless of the number of treatment facilities constructed or the number of basin management plans completed, in the final analysis, program effectiveness can only be measured in terms of actual water quality improvements. And, this can be achieved only through adequate monitoring of water quality.

Thus, FWQA has been reorienting and expanding its data collection activities to identify compliance and noncompliance with water quality standards; improvements in water quality resulting from pollution abatement measures, such as waste treatment facility construction; and emerging water quality problems that should be corrected before crises arise.

Key steps required in the development of an adequate nationwide water quality surveillance system involve planning the system in close coordination with State and other Federal water data collection agencies and implementing the system by utilizing existing programs of FWQA, State pollution control agencies and other Federal water data collection agencies, principally the U.S. Geological Survey. During the past year, plans for integrated State-Federal water quality monitoring systems have been developed for six of the nine FWQA Regions and are now being implemented.

If a surveillance system is to be fully effective, thorough attention must be given to its design as well as its operation. In recognition of this, a systems analysis approach to the design of optimum water quality monitoring programs is under development. This approach will per-

These automatic monitors gather the accurate, up-to-date data required for effective implementation of water quality standards.



mit the monitoring subsystems, making up the nationwide integrated State-Federal surveillance system, to be designed and updated as necessary on a uniform basis in such a way as to ensure maximum program effectiveness.

To ensure the reliability of data collected by the coordinated program, an analytical quality control program, which is now under development, will become an integral part of the overall system. All cooperating agencies will be expected to participate in such a program. Thus far, a manual entitled, *Federal Water Pollution Control Administration Methods for Chemical Analysis of Water and Wastes, 1969*, has been published and distributed to all participating laboratories. Similar manuals covering standard biological and bacteriological laboratory procedures are under development. Quality control checks and procedures that will be employed on a routine basis in participating laboratories are also being developed.

A portion of the coordinated network is already in operation. It presently utilizes approximately 400 FWQA-funded and operated stations, 260 FWQA-funded and U.S. Geological Survey-operated stations, 200 stations jointly funded by the State and Federal agencies and 500 State-funded and operated stations. Ultimately, the network will encompass State and Federal stations numbering in the thousands. Network data will be supplemented by the findings of the many short-term intensive field studies of specific water quality problems that are conducted by FWQA.

In addition to water quality data, detailed knowledge of waste sources, treatment and discharges is also necessary to fulfill the needs of FWQA programs. Municipal sewage and industrial wastes are the two largest sources of pollutants. During 1969, the Pollution Surveillance Branch completed the processing and analysis of data on municipal waste facilities collected in a cooperative Federal-State inventory. This effort, the first since 1962, reflects conditions as of January 1, 1968. Because the need for timely and accurate data in this area is so critical, procedures have been developed for bringing the 1968 inventory up to date and for continually updating it to keep it current. In addition, data from the implementation plan portion of the water quality standards have been correlated to and integrated with the inventory to show schedules for providing additional municipal waste disposal facilities.

As for industrial wastes, plans have been made to initiate an inventory of industrial manufacturing and processing plants. Initially, this will be an in-house effort; eventually, it will be expanded to a joint FWQA-State cooperative project. Here, again, data from the implementation plans of the water quality standards will be valuable in planning and conducting the inventory. Once established, this inventory, like that of municipal facilities, will be continuously updated.

With the recent publication by the Secretary of new construction grants regulations, data on waste sources and discharges have become even more important. These regulations require the States to show that a proposed municipal facility is a part of, and in conformity with, a basin, regional or metropolitan pollution control plan before the project is declared eligible for a construction grant. In addition, regulations prescribe as a further condition for eligibility the provision of data on all waste discharges in the immediate proximity of a proposed plant which may affect its design and operation. For these reasons, additional data will be required on wastes characteristics and strengths.

In addition to the municipal and industrial inventories, a new collection effort has been planned and initiated to provide data on thermal discharges from electric power generating plants. By agreement with the Federal Power Commission, data for this inventory will be collected by that agency through a questionnaire on environmental control information.

To achieve the objectives of the coordinated data and information program, it is essential that the data collected be evaluated in an expeditious manner and made readily available to all users. Only in this way can appropriate follow-up actions be taken. FWQA's existing computerized data storage and retrieval system (STORET), coupled with additional computer programs, will meet these requirements. All data collected by FWQA will be placed in STORET to be available for analysis and use.

Using the most up-to-date computer technology, the data collected are entered in a central computer on a daily and weekly basis by remote terminals in all FWQA Regions. Similarly, questions can be asked of the central computer from the remote terminal and receive timely responses. This application is now being expanded to include several Federal and State agencies.

Evaluation and dissemination of the large amounts of data and information collected is assisted by the STORET system. Currently, this system is being expanded to include water quality standards and uses so that many questions can be asked, such as what facilities have inadequate treatment, what type of treatment is provided or waste contributed at any source, how many miles of streams are polluted, how many miles have been improved, what is the number of violations of water quality standards and where, and what uses have been affected and over how many miles. It will be several years before all of these questions can be accurately asked and answered for each individual basin, or region, or for the Nation as a whole. However, those questions must be answered to provide an effective overview of our rate of progress, and FWQA is beginning to build towards that capability now.

A quantitative analysis of changing trends in water quality and of the progress in abating pollution nationwide will be essential in guiding the course of the national water pollution control effort. It will also contribute to the assessment of national environmental conditions and trends required under the National Environmental Policy Act of 1969 by indicating whether we are gaining ground or falling behind in pollution control.

Economic Studies

For the first time, the Nation stands on the threshold of a major effort to reverse the heritage of neglect and to face the problems of a deteriorating environment. Massive investments will be required for environmental improvement and the expenditure of these funds will have major impacts on the economy. Formulation of sound public policy will require an increasing understanding of these costs, their distribution throughout the economy, and their economic impact, both on individual communities and firms and on the economy as a whole.

For three years the Federal Water Quality Administration (FWQA) has been conducting a series of economic studies aimed at gaining a deeper understanding of these factors and at assisting the Executive Branch and the Congress in formulating national policies and legislation. These studies have included: analysis of the national costs of treating municipal and industrial wastes and the impact of these costs on State and local governments; studies of sewer user charges as a means of financing local expenditures; studies of the need for economic incentives for industrial waste control; and studies to determine the extent of animal feedlot pollution and the costs of abating it. Collectively, these studies represent the most intensive and comprehensive effort ever made to understand the costs of water pollution control.

The findings of FWQA's economic studies are submitted to Congress annually. The first report projected municipal investment requirements for the period 1969 to 1973 and assessed the impact of funding required to meet municipal waste treatment needs on the municipal governments and bond markets. The second report examined the influences that determine investment levels and concluded that the critical factors were to be found in the dynamics of the situation—in the interaction of investment with time-conditioned growth, replacement, and demand for higher plant efficiencies. It was also found that regional cost differences, transmission costs, and the influence waste loadings were extremely important factors in analyzing the economics of water pollution control.

During the past year, these cost studies have concentrated on information needed to reshape the funding of the construction grants program to make it fully adequate to meet the Nation's needs. The Secretary of the Interior's legislative proposal for a Federal, State, and local investment of $10 billion over the next four years reflects the findings of these studies. The 1970 report, *The Economics of Clean Water*, defines the rate of investment needed to close the gap for municipal waste treatment in the years immediately ahead. This report provides the most thorough estimates ever developed for the Nation's municipal sewage treatment needs and costs. Detailed studies of the pollutional impact

Polluted rivers, such as this, present a challenge to people and governments at all levels—now is the time to institute urgently needed action programs.

of the inorganic chemicals industry and concentrated animal populations were also completed as separate sub-reports.

Various aspects of the socio-economic problems of water pollution are presented in the latest report. These include discussions and conclusions about investment trends and needs, Federal cost sharing, priority systems for grant funds, public treatment of industrial wastes, and regional waste handling systems. In addition, several estimates discussed in earlier reports were reviewed in view of the latest available information. These included investment estimates for collecting sewers, separation of storm sewers, industrial waste treatment and cooling facilities, and sediment control and acid mine drainage reduction.

The Water Quality Improvement Act of 1970 requires that a complete investigation and study of all methods of financing the cost of water pollution control, other than methods authorized by existing law, be made and the results submitted to Congress by December 31, 1970. To meet this requirement, FWQA has structured a study which will deal with pollution sources of all types including, but not limited to, municipal, industrial, agricultural, land and acid mine drainage, oil and accidental spills and debris. Questions of responsibility, ability to pay and equity will be addressed in allocating potential funding requirements among the private sector and the various levels of government. The study will examine the feasibility of a wide range of financing possibilities in the light of the analysis outlined above. Potential methods will include: conventional financing; loan arrangements; user, influent and effluent charges; taxation; insurance-type arrangements and others. In addition, potentials for reducing financing requirements by means of structural policy alternatives will be assessed.

Although considerable insight into and understanding of the economics of water pollution control has been gained through past studies, there are still many unanswered questions concerning the costs of pollution abatement and the impact that efforts to cleanse our environment will have on the national economy. The challenge is clear, however: if the Nation's water resources are to be enjoyed without the burden of increasing water pollution, *now* is the time to institute prudent action to clean up our streams. The people and their government have accepted the challenge. FWQA reflects their determination and will give continuing emphasis to devising policies and programs which will create a cleaner environment in the most expeditious and economical manner.

RESEARCH, DEVELOPMENT, AND DEMONSTRATION PROGRAMS

The search for new answers is an important part of the Federal pollution control mission. Federal Water Quality Administration (FWQA) is conducting a research, development, and demonstration program which is a coordinated, problem-solving program dedicated to exploratory research of new and imaginative pollution control methods; the engineering development of these methods to solve the practical problems associated with bringing an "idea" out of the laboratory and into the real world; and the demonstration of this new technology to go that extra, normally forgotten step of showing the decision-makers that new answers, new technology have really arrived and are available for use.

The program being conducted is highly mission-oriented. Each project responds to an identified need for an answer. These needs are specified and assigned priority primarily through imput from the non-research elements of FWQA. In short, responsiveness to the research needs of the Agency is a prime responsibility of this program.

There are really only two major categories of "answers" being sought. First, how are the water quality goals defined? Second, how are these goals reached with maximum effectiveness and at least cost? With regard to quality goals, research is required on the effects of pollution. What are they? How is the degree of effect related to the amount of pollution? And, how can the level and type of effect be predicted in advance? With this type of information we can improve and extend the water quality standards now being established and implemented for the Nation's waters. Simply knowing what water quality is required is not enough, of course. In those cases where we already have some ability to control pollution, new and improved means for control are needed in order to reduce the cost of pollution abatement to the very minimum possible. Beyond this, the need to develop and demonstrate means for controlling that pollution, which today is literally uncontrollable or untreatable at any cost, is assuming a high priority. Corollary to and, in fact, inseparable from this objective is the simultaneous upgrading of wastewater quality such that used water may be reused again—a concept of major significance in extending our relatively dwindling fresh water supply.

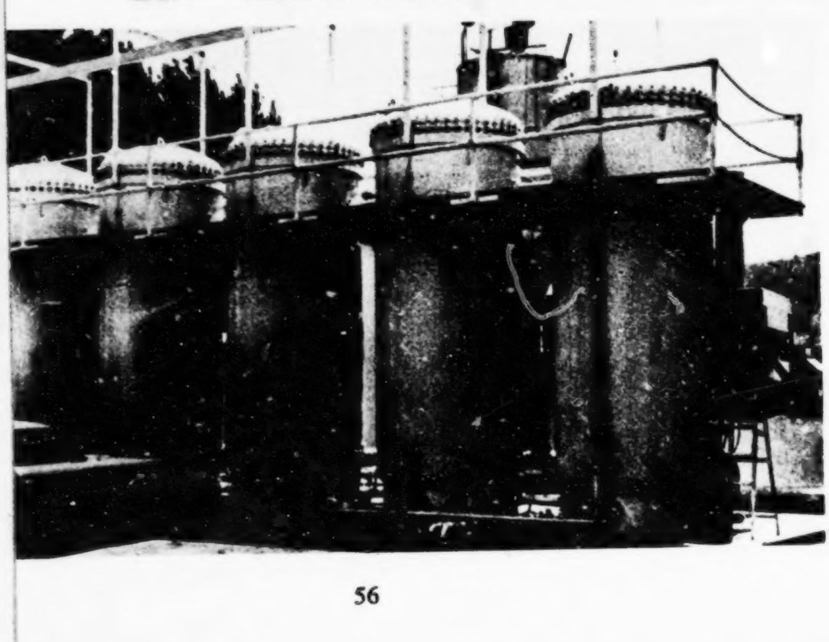
To assist in managing this program and in setting priorities and resource allocations, a problem-oriented project categorization is utilized. Eight major categories exist: the first five relate to single-source-related pollution problems from municipal, industrial, agricultural, mining, and from other sources. The last three categories relate to problems of a multiple-source nature, where the answers will be applicable broadly to many different sources of pollution. In the single-source category FWQA is working on such pollution problems as combined sewer discharges, pulp and paper wastes, agricultural runoff, acid mine drainage and oil pollution. In the multi-source categories FWQA has programs on eutrophication, thermal pollution, removal of nutrients and refractory organics, and effects of pesticides and other pollutants on fish and aquatic life. The mechanisms utilized in carrying out this program are three-fold:

(1) In-house research and development at eight laboratory locations and a number of associated field sites.

(2) Contract projects, primarily with industry.

(3) Grant projects with universities, industries, States and municipalities.

Research on advanced waste treatment technology is carried out at FWQA laboratories and through field evaluations.



Contract projects are funded entirely with Federal dollars and are utilized primarily for laboratory investigations and pilot-scale research projects which involve a high degree of uncertainty and which are primarily aimed at determination of feasibility and development of design requirements. These are not the types of projects that municipalities and private corporations will readily sponsor with matching funds because of the large degree of risk involved. The work performed under contracts often requires highly-specialized personnel, equipment and facilities, having a high value over a short period of time, but limited value in the long term.

Grant projects require some level of matching support from the grantee. Grants are employed in meeting objectives where it is desirable to utilize State, municipal, academic or industrial talents and expertise in carrying out research, development and, often, demonstration efforts on a cost-sharing basis to the mutual benefit of both the Federal government and the grantee.

FWQA's in-house activity forms the real foundation of an effective overall program. In-house researchers must establish objectives and plans of attack; they must review and evaluate the many, many project proposals received by this Agency; and they must be the ones to integrate the results of these efforts into a usable and applicable form. To do this most effectively, in-house staff must be involved in the work for which they are responsible.

FWQA's program is predicated on the assignment of specific areas of technical responsibility to each of eight laboratories. In this way, each laboratory functions as a national focal point for research on a given set of problems, and duplication of facilities, staff and effort among the various laboratories is avoided. Research laboratories are located in Cincinnati, Ohio; Athens, Gerogia; Ada, Oklahoma; Corvallis, Oregon; College, Alaska; Duluth, Minnesota; Narragansett, Rhode Island; and Edison, New Jersey. These laboratories are also responsible for operating a number of field sites to carrying out pilot plant work and necessary field studies. FWQA operates such field sites at Pomona and Firebaugh, California; Ely, Minnesota; Lebanon and Newtown, Ohio; Norton, West Virginia; and Washington, D.C.

In addition to the in-house efforts carried on at agency laboratories, FWQA is also involved in a number of joint efforts with the Bureau of Reclamation, Atomic Energy Commission, Office of Saline Water, Office of Water Resources Research, Public Health Service, and Tennessee Valley Authority.

Notable in the research, development and demonstration program are the special authorities to support both pilot-scale and full-scale demonstration projects on storm and combined sewer discharges, advanced waste treatment and wastewater renovation, and industrial waste treatment and control. These projects are particularly significant in permitting FWQA to carry on research and development findings into the demonstration phase, thereby literally showing what can be accomplished through the use of new technology and at what cost.

In order to effectively manage this program, communicate the results to users, and respond to special Administration, Congressional and public requests, a computerized management information system was instituted. As a result, up-to-date information is readily available on nearly 2,000 projects, on future needs, on priorities, on work plans, and on necessary planning, programming and budgeting data to effectively direct future efforts.

A supplementary project reports system has been established for the acquisition, filing, indexing and, most importantly, dissemination of research results. The final results in the form of reports and publications are indexed into a technical library, distributed, and made known to a wide range of users both inside and outside FWQA. In Executive Order 11514, President Nixon directed that the results of Federal research programs be made available for widespread use. FWQA will continue to emphasize this important aspect of the research, development and demonstration program.

The problems of water pollution, as previously described in the "Water Pollution and the Environment" chapter of this report, are so complex, so varied and so numerous that they have multiplied faster than solutions. To ensure that our technology is improving and to make existing control methods more effective in the overall effort to make America's waters clean and useable, FWQA has intensified its research programs. The Water Quality Improvement Act of 1970, enacted and signed into law recently, added emphasis to research programs in oil pollution, acid mine drainage, vessel pollution, and pollution in the Great Lakes, and FWQA is moving to meet these responsibilities.

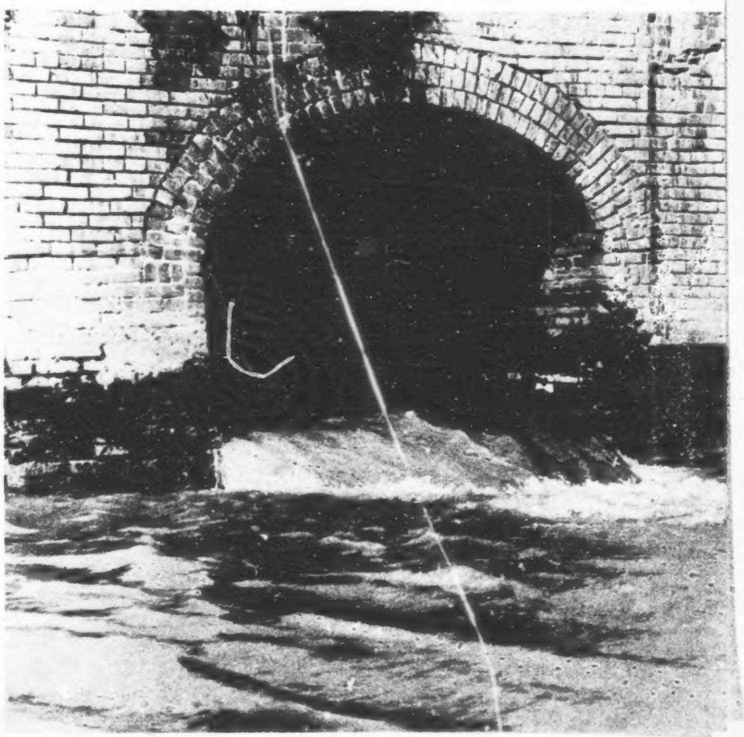
The eight categories of research being conducted in FWQA's program are directed at solving the problems already discussed. These categories, the problems at which they are focused, and some of the recent accomplishments of the research are discussed below.

Municipal Pollution Control Technology

Municipal wastes, as indicated earlier, are a major source of pollution in the United States. Although a technology to treat these wastes has already been developed and is being applied, FWQA is continuing the search for better and more efficient ways of treating municipal wastes in conventional systems. For example, significant improvement and upgrading of treatment in overloaded plants has been demonstrated using synthetic organic polyelectrolytes.

Another major concern is research on methods to control the more complex municipal problems, such as combined sewer and urban sediment control. Combined sewers carry both sanitary sewage and urban runoff. During storms, the volumes in these sewers are often too much for local treatment plants and wastes are discharged untreated. Yet control of these discharges has largely been neglected until recent years because the only method of solving

Improved methods of controlling storm sewers are being developed.



the problem was separation of combined sewers, a costly and disruptive process. Through the efforts of FWQA's research program, a new technology for control of sewer discharges is being developed.

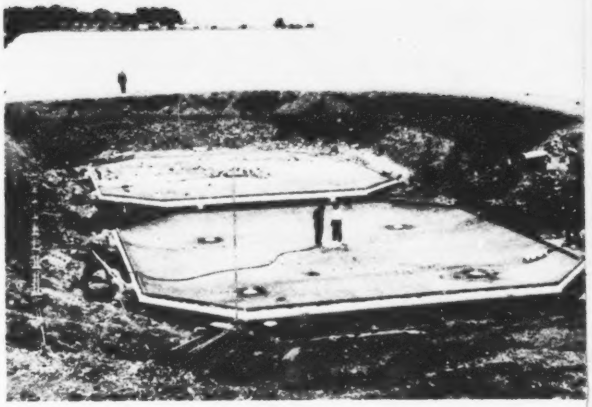
One of the alternatives being demonstrated is storage of excessive flows until they can be released to the treatment plants. Full-scale storage facilities under construction in Boston, Massachusetts; Milwaukee, Wisconsin; Dallas, Texas; and Shelbyville, Illinois, have determined the design criteria necessary for such facilities. Cost-effectiveness evaluation will allow other communities to economically design similar combined sewer pollution abatement facilities.

Another major alternative is treatment. Existing municipal and industrial treatment processes cannot be utilized for combined sewer overflow treatment because of the intermittent, widely fluctuating high-flow rates and the dynamic quality changes of combined sewer overflows. Screening and dissolved air flotation are two treatment methods which are amenable to the above constraints.

The demonstration of a novel, rotating collar, vibratory base screening treatment unit for combined sewer overflows was carried out in Portland, Oregon, in 1969. The unit provided primary treatment to normally bypassed sewage at a cost only slightly higher than the equivalent conventional treatment. The space utilization of the screens is one-tenth that of settling tanks.

Through these studies, a combination of control methods is being developed which will be applicable to the different combined and stormwater sewer problems throughout the country. Although determinations of the cost of controlling these discharges by the new methods being demonstrated are very preliminary, the total job may cost only about one-third of the earlier estimates based on separation.

Erosion and sediment from urban areas cloud rivers and impair their use. These waters generally are not confined to sewers, so the above methods cannot be applied to solve the problem. The National Association of Counties Reseach Foundation in conjunction with FWQA, has therefore developed a *Community Action Guide for Erosion and Sediment Control.* This document will aid local officials in developing erosion and sediment control ordinances to control pollution from urban development construction projects. The control programs would be based on the establishment of control ordinances and on the use of present technology, such as vegetation control, mulching, sediment traps and other common erosion control practices. Adoption of effective control programs based on this guide will substantially reduce the silt load to urban waters.



Under water storage facilities for combined sewer overflows have been developed with the help of Federal grants.

Of great importance is FWQA's research on joint treatment of municipal and industrial wastes. As has been pointed out, the benefits of joint treatment are considerable. Industry, while paying operating costs, is spared the burden of the capital costs; and regionalization of waste treatment and economies of scale help communities achieve more effective pollution control.

The benefits of joint treatment are recognized. Certain industrial wastes, however, have proved difficult to treat effectively in combination with domestic wastes. In this regard, our demonstration of the feasibility of joint treatment of domestic sewage and semi-chemical pulping waste from a paper mill in 1969 at Erie, Pennsylvania, was an encouraging breakthrough.

In addition, a joint municipal-industrial wastewater treatment engineering study of the Onondaga Lake watershed was also completed last year. Approximately 140 industries in the watershed participated in the study by assisting in characterizing their wastes, and it was recommended that a joint treatment system be implemented by Onondaga County during the remaining phases of the project.

The successful demonstration of joint treatment of industrial wastes in municipal treatment systems holds great promise for the future. FWQA is encouraging such joint treatment and numerous communities with significant industry within their jurisdiction are considering such treatment.

Industrial Pollution Control Technology

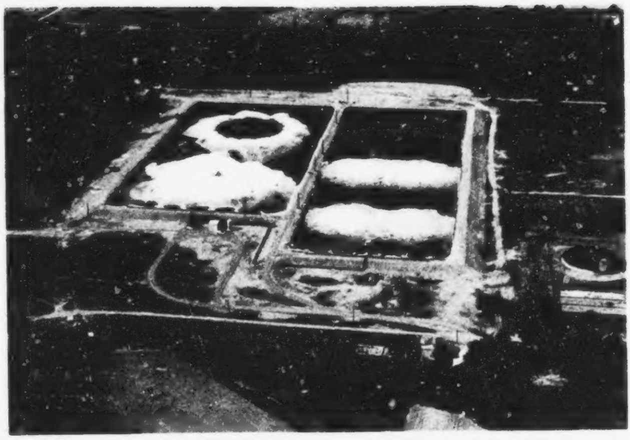
Industrial waste discharges, together with municipal wastes, comprise the two largest sources of pollution. Industrial wastes are complex—a result of the wide variety of products manufactured—and are discharged in enormous volumes. In order to effectively control pollution, industries must often face the heavy financial burden of installing waste treatment facilities. Current waste treatment methods, while sometimes adequate, are expensive and in many instances offer little hope of providing the type and degree of treatment which will be required in the future. Because of the competitive economic aspects, industries are continually searching for new means of reducing their wastes at lower costs.

An effective attack on industrial pollution—wastes from metal, chemical, petroleum, coal, paper and other product manufacture—requires a cooperative industry-government effort to conceive, develop, demonstrate, and install treatment processes, process modifications, and water conservation programs. Already, research funded by FWQA covers some industrial problems from almost all major sources of industrial pollution.

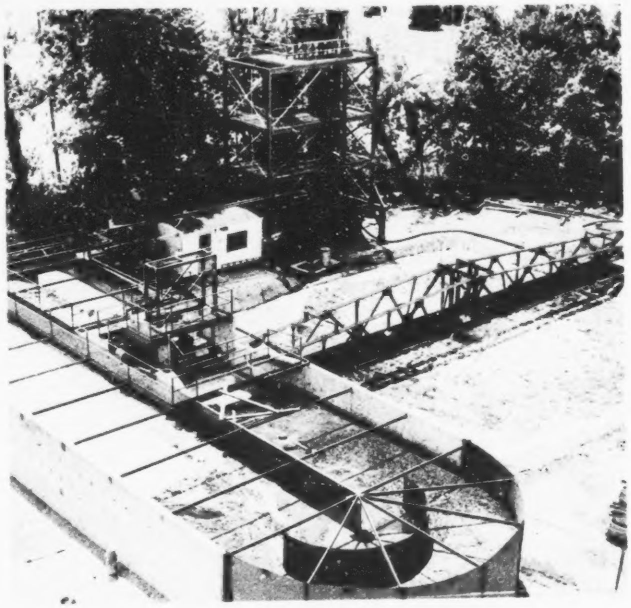
A grant project with the American Oil Company at its Mandan, North Dakota, refinery has demonstrated the feasibility of using a commercially available fluidized-bed incinerator for the disposition of refinery sludges. The project was initiated in May, 1968, and inquiries to date by others in the industry show a keen interest in the utilization of this technique to resolve their sludge disposal problems. Another oil company has indicated its desire to apply the method at its own refinery. The American Oil Company is presently considering the possible use of a much larger fluidized-bed unit at the Whiting, Indiana, refinery in the near future.

The color of pulp and paper mill wastes has long been an aesthetic nuisance, difficult to control. Interstate Paper Corporation at Riceboro, Georgia, has demonstrated the lime coagulation process for the removal of color from kraft pulping effluents. This installation is the first full-scale operation of its type and has obtained color reductions greater than 90 percent throughout the experimental program. The results of this grant have been utilized by both paper companies and State agencies in selection of effluent treatment processes to meet receiving water quality standards.

FWQA and the State of Vermont have jointly entered into a demonstration project which provides an excellent illustration of the side benefits of some industrial pollution control. A project initiated in late 1968 on the conversion of cottage cheese whey into an edible grade material has produced, on a pilot-scale, a high grade food powder for human consumption. A plant for the full-scale demonstration of the developed process has been completed and will be operable in 1970. The plant could ultimately have the capacity to produce 20 million pounds per year of dried edible whey. Cheese whey produced in this country represents pollution equivalent to that produced by a population of 16 million people.



FWQA research and development grants have been made to the pulp and paper industry to develop more effective and less costly treatment processes.



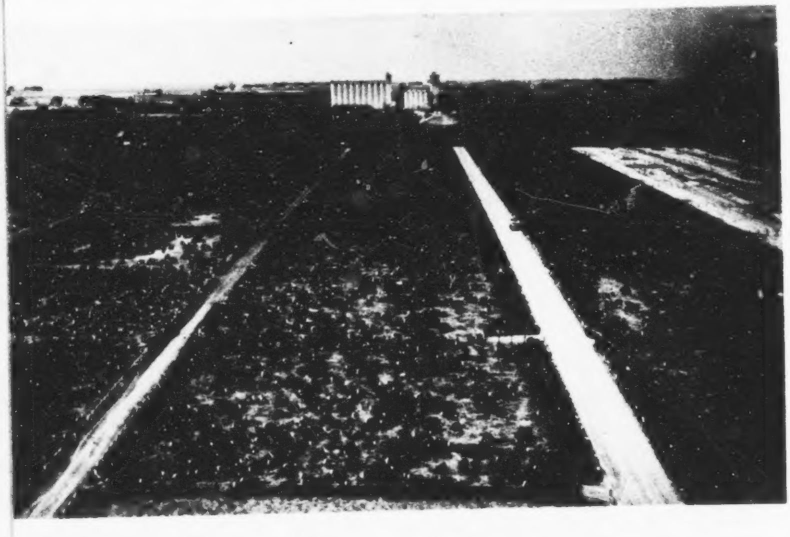
With the expansion of both the population and the industrial sector and the corresponding needs for water, conservation of water is becoming increasingly important. Much of today's research is directed toward finding easy-to-treat and re-use water effluents. A project with the Johns-Manville Products Corporation in Defiance, Ohio, demonstrates that a wastewater treatment system using diatomite filtration can effectively treat a waste stream, containing glass fibers, caustic and phenols, to a quality suitable for process reuse. The treatment facilities are operating on a 72,000 gallon-per-day basis with effective pollution control a demonstrated success.

Agricultural Pollution Control Technology

The most difficult sources of wastes to control are those that do not come out of pipes. Agricultural pollution is a good example of such "diffuse" wastes. Major forms of pollution associated with agriculture have already been identified as problems in earlier sections of the report. They include: nutrients; pesticides; salts and other materials in irrigation return flows; animal feedlot wastes; and silt and other solids from logging operations. Most of these wastes are not collectible and, therefore, cannot be treated in a conventional fashion. New and imaginative solutions are being sought for these problems.

Projects with Cornell University, South Carolina State, and South Dakota University are aimed at studying the addition of nutrients to streams from cropping practices as related to their respective geoagranomic areas. This is a precursor to the development of criteria for new management concepts that include considerations for waste management.

Thousands of beef cattle are concentrated in pens. Drainage from such feedlots is a major pollution problem.



The quality of irrigation return flows is a major problem in the arid sections of the country, primarily because of nutrients, silt, and salts. Treatment of such flows has long been considered impractical. A development program at Firebaugh, California, has developed two techniques for removing nitrates from irrigation return waters. These will be demonstrated on an engineering scale to obtain more definitive operating and cost data that will be applicable to a complete treatment system for the entire San Luis Drain.

Work is also under way with the Bureau of Reclamation to demonstrate a technique of forecasting the effects of irrigation practices on the quality of underground aquifers and surface streams before lands are irrigated. This method will enable us to make better provision for avoiding water quality damage in planning and developing new irrigation projects.

The tremendous load of animal wastes discharged from a rapidly growing number of animal feedlots is an area of particular concern in FWQA's research program. Projects have been initiated to demonstrate available techniques for treating runoff from animal feeding operations and for preventing its discharge to receiving waters. These include activated sludge, oxidation ditch, anaerobic-aerobic lagooning and management changes to control and collect the runoff. Cooperative projects with the Department of Agriculture have also been initiated to determine the quantity and pathways of nitrate addition to surface streams and underground water formations from excreta in beef feeding operations.

Mining Pollution Control Technology

Mine drainage, as noted in the discussions in "Water Pollution and the Environment" is a major pollution problem, particularly in the Appalachian Region. Past attempts to prevent or reduce such drainage have generally failed, and FWQA is emphasizing research to demonstrate the technology necessary to control such wastes.

A new method of preventing the formation of acid mine drainage has been proven through laboratory studies which have shown that an inert gas atmosphere which displaces oxygen will prevent acid mine drainage formation. This method is presently being field tested in an abandoned underground mine and is also being studied for use in operating underground mines. When applied to an operating mine this technique might also reduce the fire and explosion hazards to gassy mines.

Two methods of hydraulically sealing underground mines have also been demonstrated in the field. The first method used quick setting cementation materials placed near the mine portal; it was, however, relatively expensive. The second method used lime and limestone to eventually form an impermeable seal, also placed near the mine portal. This method was less expensive than the former.

The passage of the Water Quality Improvement Act of 1970 adds new emphasis to FWQA's program to demonstrate abatement techniques which will contribute substantially to effective and practical methods of acid or other mine water pollution control. As a result of the mandate of the new Act, the Agency will be stepping up its research in this area.

Control of Pollution from Other Sources

In addition to the pollutants already identified, there are a number of very significant waste sources for which improved technology is needed. These include recreational and commercial vessels, construction projects and impoundments, salt water intrusion, dredging, and oil pollution. Although some work has been done on all these problems, emphasis was given to vessel and oil pollution. The Water Quality Improvement Act of 1970 directs further attention to these sources of waste.

Increasing amounts of wastes are discharged from the ever-growing number of recreational and commercial vessels which use both inland and coastal waters. Suitable on-board equipment for properly treating or holding vessel wastes must be developed. In response to a request for proposals to demonstrate the feasibility of various control and/or treatment concepts for wastes generated on vessels, four projects were undertaken in 1969. One system demonstrated holding tanks on pleasure craft and an underwater storage bag for temporary storage of the pleasure craft waste prior to disposal by trucking to a sewage treatment plant. Other concepts are for holding tanks on large vessels and treatment utilizing an electro-chemical flocculating concept.

Closely related to vessel waste control, oil pollution has become a problem of major proportions and of increasing concern. The effects of drilling and tanker accidents, which release large quantities of crude oil into our coastal waters, have been described in detail elsewhere in the report. But the technology to avoid and to clean up such "spills" is woefully inadequate.

BENJAMIN F. FAIRLES

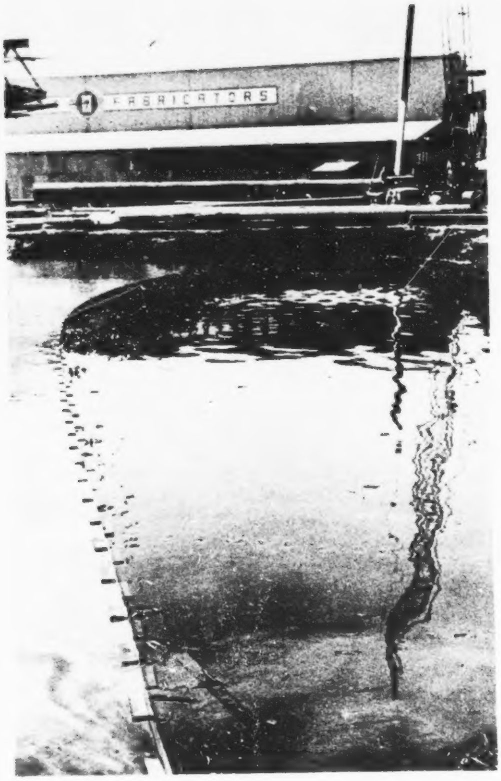
A sewage treatment system is installed aboard a Great Lakes freighter.

Primary program emphasis last year was placed on development of devices and techniques to restore oil contaminated beaches and to harvest oil from the water surface without the aid of additives. Fabrication of a unique centrifugal oil-water separator having high capacity and efficiency and relatively low power requirements was recently completed. An oil harvesting device for oil clean-up is also being designed and fabricated. The two units will be combined and tested at sea early in 1970.

Demonstration projects in progress under the direction of the Maine Port Authority in Portland, Maine, and the City of Buffalo, New York, developed valuable practical information on the effectiveness of a variety of oil containment and clean-up devices and techniques which were evaluated under actual conditions. In-sewer instrumentation for oil detection and oil traps was developed, demonstrated and evaluated. Modification of the inverted siphon is indicated to be an effective oil trap.

In order to use any of the above methods of treatment, the oil must be contained in the local area of the discharge or spill. A system of booms is generally used for containment, but the present systems have not been effective. Model studies were therefore initiated to develop criteria for effective design of booms for harbors, rivers and estuaries.

An increasing amount of attention is being given to methods of preventing oil pollution from tankers. For example, the purpose of one project started in 1969 was to determine the



Straw and booms are still two of the best methods of controlling and cleaning up oil spills. Research and development efforts are aimed at improving this technology.

feasibility of transporting oil in the form of a highly viscous emulsion, created by using ultrasonic techniques and certain additives. The thicker substance of the oil would prevent cargo loss in event of accidents. The same principle is being applied in the development of chemicals to rapidly gel oil within a tanker compartment after leaks are developed.

A joint American Petroleum Institute-FWQA Conference on Prevention and Control of Oil Spills was held in December, 1969. The meeting attracted over 1,200 registrants and 42 equipment exhibitors. Information developed in the course of industry and government programs in this country and the United Kingdom was exchanged, and reports were made on experience with the clean-up of recent large spills. The Conference summary pointed out some advances in oil pollution control technology but strongly emphasized the need for much greater effort in this area.

Water Quality Control Technology

This part of the research program includes all research, development and demonstration directed toward: the prevention and control of accelerated eutrophication and thermal pollution; the control of pollution by means other than waste treatment (e.g. industrial manufacturing process change to eliminate a waste); the socio-economic, legal and institutional aspects of pollution; the assessment and control of pollution in extremely cold climates; and the identification, source and fate of pollutants in surface, ground and coastal waters.

The accelerated aging (eutrophication) of our lakes, brought on by the increased discharge of nutrients (nitrogen and phosphorous) from municipal and industrial wastes and land runoff, has become a problem of major proportions. Technology has rapidly developed to effectively and economically control phosphorous discharges from municipal treatment plants to alleviate a portion of the problem and hopefully retard the aging process. Efforts are being made toward the replacement of the phosphates in laundry detergents with environmentally less harmful materials to eliminate this major source of nutrients. Many and varied approaches are being considered and new ideas sought to combat this extremely complex problem.

Another problem facing us results from the increased demand for electrical energy and the attendant requirement to dissipate waste heat to the aquatic environment. Significant effort is being expended to determine the actual temperature requirements of our surface waters and aquatic life and to discover means of preventing harmful effects of heat.

Development of water quality control technology will become of major and increasing importance as the pollution control payoff from waste treatment becomes increasingly marginal. This involves techniques other than conventional treatment systems, such as industrial process change or management of water resources to minimize the effect of waste discharges. These techniques are applicable in concert with or after high levels of waste treatment are provided.

Cold climate research has also proven to be of significant benefit. Many problems which have been solved elsewhere have required reevaluation and investigation in Alaska because of the extremes of arctic climate. Efforts are focused on studying pollution problems specifically in regard to the arctic environment, such as determining the impact on Alaskan streams of sewage and other wastes resulting from a rapidly expanding population and industrial growth. An extended aeration system to stabilize wastewater has proven effective in arctic climates, and the use of physical-chemical techniques to provide reusable water for North Slope development camps offers promise.

The Water Quality Improvement Act of 1970 contains a special provision for demonstration of methods to provide central community facilities for safe water and pollution control in Alaskan villages. Today only eight percent of the native homes in Alaska have adequate sanitation facilities. FWQA's research and development staff will be working with the State of Alaska and the Department of Health, Education and Welfare to implement this provision of the new Act and to provide safe water and waste treatment for Alaskan natives, using both conventional and innovative methods.

Waste Treatment and Ultimate Disposal Technology

Waste treatment and ultimate disposal technology focuses on the development and demonstration of new processes and process modifications to control pollution from any source.

There are actually two corollary objectives to be attained through improved waste treatment technology. The obvious one is the alleviation of the Nation's increasing water pollution problems through removal of pollutants from waste effluents; the other is the renovation of wastewaters for deliberate reuse as industrial, agricultural, recreational, or, in some cases, even municipal supplies. These two objectives cannot really be separated, for as our ability to cleanse wastewaters increases, the resulting product water approaches closer and closer to, and may even exceed, the quality of a water supply. This concept, perhaps startling to the average citizen, will nonetheless play a larger and larger role in water resource management, especially in water-short areas.

The need for and the degree of advanced waste treatment will vary with the individual local needs for control of pollution and/or increased water supplies. To meet the spectrum of needs, almost 100 different processes and process variations for treatment and disposal of waterborne wastes have been considered. Some 85 of these processes are under active study at this time at almost 150 different locations throughout the United States. These studies are aimed at determining the efficacy and the cost of the various unit processes which may make up the advanced waste treatment systems of the future.

The fruits of this program have become apparent with the emergence of several advanced waste treatment systems into the demonstration plant phase. The methods being developed range across the spectrum of physical, chemical and biological techniques. They range from the "ordinary," such as filtration and gravity settling, through the "novel," such as biological denitrification, to the "exotic," such as reverse osmosis or ultrafiltration.

The government's investment in this effort has paid off handsomely. First generation process technology, capable of achieving greatly improved pollution control of municipal wastes, has already been brought to the stage of full-scale demonstration and is now available for use under many conditions.

An excellent example of the application of this technology was announced March 24, 1970, by Secretary Hickel and Mayor Walter E. Washington of Washington, D.C. The new process to be installed at the District of Columbia Blue Plains wastewater treatment plant will substantially reduce the pollution of the Potomac and is applicable to rivers and lakes throughout the Nation.

The new technique is the result of a series of research projects conducted jointly by FWQA and the District at the Blue Plains plant. Pilot plants have been testing the new system for two years. The process couples advanced biological techniques with a new physical-chemical treatment. The precipitation phase of the treatment process employs a greater use of chemicals than current processes, and pure oxygen, instead of air, is used in the biological phase of the treatment. The new process appears capable of removing nearly 100 percent of the biological impurities, 96 percent of the phosphates and 85 percent of the nitrogen in wastewater.

The results of this program have provided the necessary technology to reduce the pollution from municipal sources to essentially zero. The present cost is within economic feasibility, but further efforts are needed to optimize both processes and economics. This breakthrough will mean the development of effective, safe and economical wastewater systems, which, in effect, will amount to the same thing as creating a new water supply.

Water Quality Requirements Research

This program provides information on the effect of pollution needed to provide an improved scientific basis for determining the water quality necessary for municipal, industrial, agricultural, and recreational uses and for the propagation of fish and other aquatic life. This information is essential to the establishment and refinement of the Nation's water quality standards. Because of the tremendous number of new chemical compounds being synthesized and finding their way into our environment each year, intensive research investigations must be conducted to develop a predictive capability that will allow us to predict the potential pollutional impact of these compounds in advance.

Far too little is known about the effects of pollution. The drastic effects, such as the massive fish kill, can be easily recognized, but quite often the true cause of such events cannot be defined even with extensive investigation. To look ahead and to predict the occurrence of such events is, unfortunately, well beyond our current capability for any but the simplest stream systems under the least complicated set of environmental conditions and pollution loads. There is also the challenge of detecting, understanding and preventing the more subtle, long-term effects of pollution, which could, even now, be robbing us of valuable water resources. Such effects, as yet unknown, may be just as severe as the sudden fish kill, the unpalatable water supply or the condemned bathing beach. Because these problems are difficult to solve and the starting baseline inadequate, a rapidly accelerated program has been initiated.

Extensive, background data has been acquired and new test methods have been developed to better and more rapidly define the requirements for many uses. For example, a comprehensive research effort to develop sound information upon which to base temperature standards is underway. A temporary field site at a power plant has been established. A standard testing section to determine safe concentration of industrial waste in a natural waterway also continues to show promise. Our research on water quality requirements will continue its accelerated effort to provide the information necessary for the establishment of scientifically sound water quality bases.

Although there are monumental problems still facing the research program, the Agency and the Nation, there is much that is already known; there are problems that have economical solutions. In the future, considerable effort will be focused on putting the results of the research, development and demonstration program in the hands of those charged with implementing water pollution control in our Nation.

THE HUMAN ELEMENT

In the final analysis, success or failure of the national pollution control effort will depend primarily upon the human element.

It will depend upon an informed public, which can express its voice intelligently and effectively in decisions affecting the quality of its environment. The President's March 7 Executive Order, issued in furtherance of the National Environmental Policy Act of 1969, placed great emphasis upon the need of the American people to know. He directed all Federal agencies to develop procedures for keeping the public fully informed on the environmental impact of Federal plans and programs and for enabling them to express their voice through public hearings on these issues.

Our success will also depend upon training and motivating a skilled work force to undertake the complex and technically demanding tasks of pollution control. People of many diverse skills and backgrounds will be needed to man the waste treatment plants, the laboratories, the offices of State and Federal regulatory agencies, industries, universities and local governments.

For the long run, the course of pollution control will be dependent most of all upon the attitudes and activities of the Nation's young people. As a group they have perceived—perhaps better than anyone else—that the quality of their lives in future years will depend on what we do about the environment today.

For all these reasons, FWQA is placing heavy emphasis upon the human element in pollution control—through informing the American public, through working with youth and through training and manpower development.

Informing the American Public

FWQA's public information program is founded on the firm conviction that our agency has a major responsibility to meet the American public's need and right to know.

Public information involves much more than mere voicing of official policy. It involves providing the public with full information on efforts to clean up the Nation's waterways, even if such disclosures may sometimes be controversial. This outlook recognizes that public information is often in opposition to public relations, and that its function is to serve the public first. As Commissioner Dominick recently told a group of FWQA information officers, they "are going to have to serve as the innovators, as the creative force, as the non-bureaucratic force, as the force in the Agency which gives us stimulation, new blood, new life, new challenges, new headaches—which gives us all of the things that a Federal bureaucracy could do without."

FWQA has received recognition for its information efforts. Senate Minority Leader Hugh Scott said in the *Congressional Record* of February 9, 1970: "President Nixon, in his State of the Union message, termed environment 'the great question of the 1970's.' It has become a matter of survival. Yet, despite some encouraging signs, too many Americans are still unaware of, or refuse to face up to, the danger. Clearly, there is an informational challenge as well.

'With this in mind, I was particularly gratified to learn that the Washington Chapter of the Public Relations Society of America has, for the second consecutive year, presented its Toth Award for professional excellence to FWQA's Public Information Office. With imagination, inspiration, and ingenuity, they have been alerting America to the multiplying dangers of pollution. Their message is crucial, and they richly deserve this recognition."

The message is being given to the American public by mail, by telephone, and in many other ways. Telephone requests from the news media, students, parents, service and fraternal organizations, and the general public have come from approximately 250 a week last year to nearly 600 a week at present. Correspondence requiring replies has risen from 4,000 a month last year to an average of 5,000 a month so far. Over the past 30 months, the Public Information Office has distributed over 2 million brochures, leaflets, and folders dealing with such subjects as water quality standards, estuaries, heat pollution, acid mine drainage, a primer on waste water treatment, fish kills, what citizens can do about water pollution, vessel pollution, and manpower and training needs. FWQA exhibits and posters have been used by the United States Post Office, the Water Pollution Control Federation, the Izaak Walton League of America, the Audubon Society, the National Rivers and Harbors Congress, the Boy Scouts of America and numerous State fairs and schools.

FWQA's efforts to inform the public have shown particularly gratifying results in television and radio campaigns. Eight film spots have been distributed to television networks and stations coast-to-coast. These spots were produced on what Variety Magazine described as a "shoestring" budget and were good enough to "make Madison Avenue shiver and shake." The Variety writeup continued: "The chiller is that the FWPCA (sic) division of the USD of I (United States Department of the Interior) did it on a production budget totaling $31,000, without an ad agency—and with a producer who had never turned out a blurb before." The International Broadcasting Awards and the American Television Commercial Awards—the advertising world's version of the Academy Awards—cited the "Clean Water" television spots as outstanding in the Public Service Category. Twenty-five radio "Clean Water" spot announcements were produced by FWQA's public information program. Some were interviews with prominent and average citizens, fishermen, conservationists and resort owners who had suffered as a result of water pollution. Another radio series provided a recording of New Orleans jazz by the Chicago Footwarmers, in which variations of popular songs were adapted to the theme of water pollution control.

The television and radio campaign has produced results. Mail addressed to "Clean Water, Washington, D.C.", solicited from viewers and listeners has shown a sharp rise. These letters are answered with literature which gives the correspondent an appreciation of the problem and of means to rectify it through community action.

Of course there is a temptation, in the midst of the ecological furor, to be overzealous. As a prominent columist observed, "The environment issue lends itself to grandstanding." It is a situation in which the fear words and the bright blue words come too easily. The public must not only be alerted to hazards, but also apprised of progress—progress being made in research, in clean-up agreements reached with industry, and in successful new approaches to the task at hand. Of the some 200 FWQA press releases issued since Secretary Hickel took office, many have dealt with new approaches for turning wastes into usable products, for using sludge as a fertilizer for crops, for new methods for controlling pollution from combined storm sewers—as well as with the oil disasters, the dying lakes, and the dangers posed by new contaminants.

The Water Quality Improvement Act of 1970 also points to the importance of adequately recognizing progress in pollution control. The Act authorized a program of official recognition by the Federal government to industrial organizations and local authorities which have demonstrated outstanding technological or innovative achievements in their pollution abatement programs.

RADIO
CLEAN
WATER

Literature and radio campaigns inform the public of water pollution problems and solutions.

Looking to the future, the public information program of FWQA has produced a film entitled, *The Gifts*, which will be distributed to citizens groups and television. The movie on water pollution and its impact on the chain of life is narrated by Lorne Green, with original music by Skitch Henderson, and again sounds the theme that we must act—now.

In the publications field, a new booklet aimed at grade school children is being planned. The booklet may use drawings done by children because of their fresh charm and appeal.

Working with Youth

The quality of the environment is fast becoming the consuming issue on our campuses. At least 500 colleges and 1,500 high schools are expected to conduct environmental teach-ins on April 22, 1970. FWQA has been invited to participate in many of these events. Over 100 staff members are expected to serve as speakers and panel members, and a large volume of literature and other materials is being made available to individual campus sponsoring organizations.

As an agency whose mission is environmental protection and preservation, FWQA since 1969 has been deeply involved with students seeking to participate more effectively in the quest for environmental quality improvement.

SCOPE (Student Council on Pollution and the Environment) was created to serve as a two-way communication link between students and government on the issue of environmental quality. For the students it is an opportunity to obtain and apply governmental expertise and information to the process of formulating solutions to environmental problems and a chance to discuss their proposals for solving environmental problems with top-level government decision-makers. For the government it is a means of getting fresh viewpoints on environmental problems and solutions. Government agencies will be able to request student study and recommendations on specific points or issues.

SCOPE is composed of students at the college and high school levels interested in the issue of environmental quality. A SCOPE group was established in each of FWQA's nine Regions in

December, 1969. The first meeting of national representatives elected by each Regional organization was held in Washington on February 20–21, 1970. At the national meeting, Secretary Hickel committed a large amount of his time to listening to SCOPE representatives' proposals and answering penetrating questions that reflected their broad concern for all facets of the environment.

SCOPE was initiated by FWQA in response to Secretary Hickel's belief that improved communications would benefit both the Federal government and concerned students. SCOPE is an innovative experiment. Now that its basic feasibility has been demonstrated, the possibility of broadening its sponsorship both within and outside the Department of the Interior is being explored. Secretary Hickel recently announced the formation of a "Task Force on Environmental Education and Youth Activities" to act as a go-between for the Department and young people concerned about the environment. The Task Force's immediate projects include being the liaison group for SCOPE and making recommendations for the creation of a National Environmental Control Organization (ECO), proposed by the Secretary and modeled after the Peace Corps. The Task Force is also programmed to provide the focal point within the Department of the Interior for its participation in future national student teach-ins. Upon request, the group will provide assistance, information, and speakers to colleges, high schools, and private organizations.

Perhaps the most basic point expressed by SCOPE members is that mankind will have to change many of its attitudes and aspects of its life-styles if we are to live within the earth's supply of natural and recreational resources over the long term. They see the need for general recognition that the earth and its inhabitants form a "closed system" and that actions by any segment of its population generally have an effect on other groups—or perhaps on the action-originating group at a later date. Further, they believe that remedial steps require changed attitudes and public acceptance and support for the expenditure of vast sums to improve the quality of our environment.

Public awareness and attitudes are at the heart of all of these broad concerns. In order to improve our understanding of the nature and magnitude of the public education task that lies ahead and to understand better what role organizations such as SCOPE can play, FWQA is seeking the help of the Institute for Creative Studies.

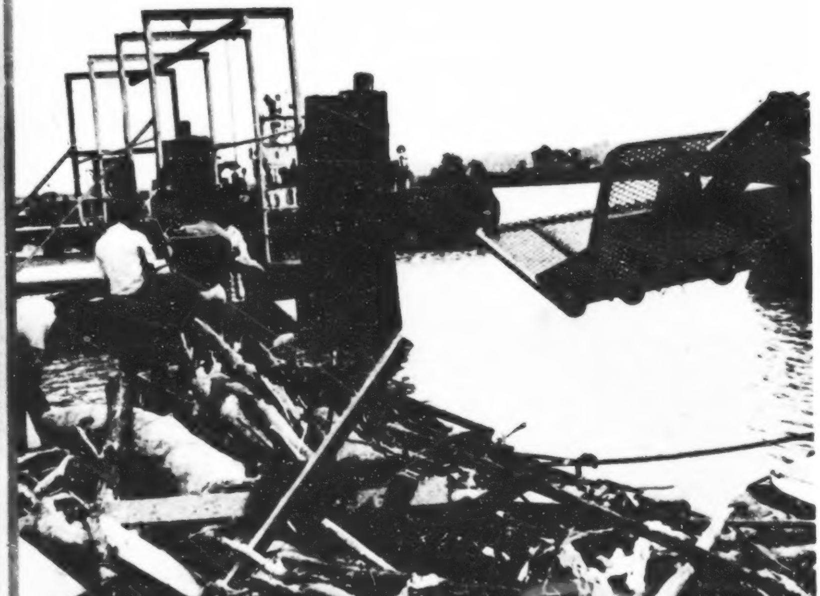
A SCOPE meeting is conducted in Richmond, Virginia.

The Institute for Creative Studies is a private, nonprofit, educational corporation which attempts to use bright, imaginative, innovative high school and college students to apply modern research techniques and scientific methods to the resolution of policy problems. The institute began as a pilot project in the summer of 1967. The research projects are funded by government contracts and the Eugene and Agnes E. Meyer Foundation.

The only controls on the individual students' research projects are regular quality control review sessions, a formal interim report, and a thorough review of each project by a panel of experts at the end of the project period.

The Institute for Creative Studies will investigate in depth the role and nature of public attitudes on water pollution control problems. Additional topics may also be considered by the Institute for Creative Studies in connection with their work for FWQA.

Young men pick up debris along the banks of the Potomac River as part of "Operation Clean Waters."



FWQA has been involved in other work with young people. For example, a program called "Operation Clean Waters" has been conceived and organized by FWQA to involve youth directly in the clean-up of water. Pilot projects have demonstrated that teams of young men aged 16 to 21 can remove tremendous amounts of debris from waterways, thereby improving their aesthetic appearance and value for recreational use. These pilot projects have been carried out in the District of Columbia, Chicago, and Puerto Rico. This program will be expanded to a number of other cities. The new projects will be supervised entirely by local governments, with FWQA staff serving as advisors.

In another approach to young people, FWQA is developing a project with the Boy Scouts of America that will be known as "Conservation Good Turn." A Boy Scout *Leader's Guide* has been prepared outlining various projects which the Scouts can undertake, such as checking to see whether their community has a waste treatment plant; if the sources of pollution from industry are under control; and where other trouble spots are developing. The *Guide* gives directions for checking the quality of water in a stream or lake. We are anxious to enlist the support of the five million Boy Scouts in this country as another volunteer cadre for protecting the environment.

In addition to the involvement with these special youth programs, FWQA has a number of on-going programs which involve youth participation and offer young people an opportunity to work or study in the field of water pollution control. These programs—to be discussed in the following section on training and manpower—include traineeships and fellowships, grants to technical, professional, and secondary schools, in-house short-term training, and part-time or summer jobs.

Training and Manpower Development

Substantial expenditures for construction grants, research and development, technical assistance, and similar endeavors are outlined in various sections of this report. Effective utilization of these funds and achievement of clean water results will basically depend on adequate staffs of skilled and motivated people, from treatment plant operators to research scientists. We must very substantially increase both the number and proficiency of those employed in the water pollution control effort and, accordingly, manpower development has become a major program thrust within FWQA.

The objectives of manpower development programs are to assist in attracting and preparing new professionals, technicians and operators and to help prepare existing personnel to do a more effective job. To meet these objectives, FWQA is pursuing a number of approaches. These include support of and work with the universities to assure an adequate flow of engineers, scientists, and other professionals into the field; conduct of short-term training by FWQA staff, designed to upgrade the skills of those already in the field; and a variety of approaches to the training of sewage treatment plant operators.

FWQA is working to increase the flow of highly trained professionals through training grants awarded to academic institutions to establish or extend the scope of advanced training in water pollution control in their engineering, biological, physical and social science departments. Under this program, institutions are encouraged to develop the specialized and multidisciplinary training of scientists, engineers and administrators in water quality management. These grants support expansion and improvement of facilities and equipment, provide partial support of faculty salaries and offer stipends, dependency allowances and tuition to trainees. In 1969 training grants were awarded to 61 institutions. This type of grant will support 693 trainees in 1970, most of whom are working toward master's degrees.

Research fellowships are also awarded to individuals for specialized graduate and postgraduate research training involving investigations particularly related to FWQA's mission. These awards provide funds for institutional costs of education, stipends for the fellow and allowances for supplies. Fellowships are generally awarded to persons working towards the Ph.D. degree, the objective being to maintain the future supply of research scientists and engineers and university professors. A long training period is required to produce researchers and teachers, generally at least three years of full-time study after the bachelor's degree has been obtained. It is extremely important to maintain a steady flow of persons under training so that there are no major gaps in the supply of trained persons available to begin research and teaching careers. About three-quarters of the Ph.D. recipients who have received FWQA support through a fellowship or training grant embark on research and university teaching careers.

In 1969, approximately 300 students supported by FWQA training grants or fellowships received advanced degrees. They will make a significant contribution towards filling the demand for new professional talent in the field.

Other steps are being taken to increase this flow of talent. FWQA will be participating in intensified Federal efforts to improve the quality of education available at black institutions in accordance with declared Presidential support for a Black College improvement program. FWQA training grants have already been awarded to two such institutions. Predominantly Negro Delaware State College received support for development of an undergraduate water chemistry course to train baccalaureate candidates for pollution control-oriented jobs in industry. More recently, a grant was awarded to Howard University to support a Master of Science in Sanitary Engineering program. In 1970, we expect to consider a proposal for training pollution control microbiologists and biochemists at Tuskegee Institute. In the coming year, other black institutions will be investigated to determine opportunities for and means of developing professional training programs in water pollution control.

We are also exploring the need to encourage pollution control training at an earlier stage through increased emphasis in junior and senior high school science curricula. As a start in this direction, the Tilton School in New Hampshire was recently awarded a grant to provide for the modification and re-writing of a previously developed teacher's guide. The guide provides objectives, procedures and teacher's plans for scientific analysis of water pollution problems and consideration of social, legislative and historical factors. The revision will be performed in the summer of 1970 by a group of teams composed of a high school science or biology teacher and a student from each of forty different schools. These teams, during the regular school year, have gained experience in field and water laboratory testing techniques and will base their revisions on this experience. The teacher's guide is expected to become basic material for initiating secondary school courses emphasizing water pollution control at schools across the country.

We must not only attract and train new people for careers in pollution control; we must turn our attention to those already in the field. Water pollution control technology and techniques are developing rapidly. To be effective, pollution control personnel must be kept up-to-date on the latest developments. One of the best means of obtaining such updating is through attendance at short-term training courses. This type of training is also needed by the ever-increasing numbers of trained people shifting from related fields to water pollution control. They need to be acquainted rapidly with current knowledge and methods.

To meet these needs, specialized and advanced technical training is offered at FWQA laboratories to government employees and others working in pollution control. Special emphasis is given to training courses or programs which assist the State and local agencies in training their personnel, thus strengthening State and local effectiveness in the water pollution control effort.

Trainees are drawn from the professional, technical and treatment plant operator ranks across the Nation. In fiscal year 1969, more than 50 of these short-term courses were presented to approximately 1,300 persons at FWQA training facilities. The curricula included a variety of technical courses in water quality management of one or two weeks' duration. Also offered are orientation courses and short technical seminars to meet the special needs of particular Federal, State and local agencies or academic institutions. For example, in 1969 FWQA presented a two-week "Water Quality Studies" course in Harrisburg, Pennsylvania, to meet the needs of that State's employees. Also, two courses were offered to assist Federal agencies in meeting their increased responsibility to prevent water pollution: "Design and Management of Sewage Treatment and Disposal for Federal Installation," and "Water Pollution Control for Federal Installations." A special course was conducted for U.S. Geological Survey personnel to enable them to participate fully in the accelerated water quality monitoring program described elsewhere in the report.

Training of sewage treatment plant operators has been an area of special and increasing emphasis in the FWQA training program. The fastest and cheapest way to significantly improve water quality in the short run would be to operate existing treatment plants at reasonably efficient levels. Too often today, multi-million dollar plants produce unsatisfactory effluents which deny desired and obtainable water uses. Usually the reason is that these expensive plants are turned over to poorly trained personnel for operation and maintenance. Poor plant operation can result in undue pollution of the receiving waters with the resulting loss of water uses, such as closed swimming beaches. Poor plant maintenance can be extremely costly in yet another way. Most waste treatment plants are designed and constructed so as to have a useful life of at least twenty years. Improper plant maintenance can actually reduce that useful plant life to one or two years in extreme cases.

The need for competent, well-trained operators in the Nation's treatment plants is obvious. Traditionally, this has been viewed as a responsibility of State and local governments. The Federal government, and FWQA in particular, has taken a more active role in the past few years for very basic reasons. The job was not being adequately done at the State and local level: a large portion of existing treatment plants were, and are, being poorly operated and maintained. State and local governments often have had difficulty marshalling the financial and staff resources needed to conduct adequate training programs on their own. Therefore, FWQA has worked to provide advice, consultation and financial assistance to State and local governments to carry out operator training.

Recently, improved operation and maintenance of treatment plants has become more than a matter of Federal encouragement and assistance; it will be required in order for States and communities to receive construction grant assistance. It would make little sense for the Federal government to embark upon a major program to assist construction of treatment works without assuring that, once built, they will be adequately operated and maintained. Secretary Hickel's recently published regulations to this effect have been described elsewhere in this report.

FWQA is supporting operator training in several ways. First, and foremost, FWQA has assisted State and local governments in qualifying for funding for operator training under a variety of existing programs administered by other Federal agencies. This involves working with State and local governments to identify training needs, to formulate training programs to meet those needs, including assistance in such areas as curriculum development and instructor training, and to obtain Federal financial assistance. FWQA then works with Federal agencies to gain acceptance for Federal support of this training and to develop procedures to make funds available. Utilizing principally Manpower Development and Training Act (MDTA) funds which are administered by the Departments of Labor and Health, Education and Welfare, FWQA assisted projects that accomplished the training of 981 operators in fifteen States and in Puerto Rico in 1969. The number of operators trained under this mechanism in 1970 will total approximately 2,800 in 30 States.

The present use of MDTA funds illustrates the successful application of a multiple-purpose governmental program. FWQA-assisted projects utilizing Manpower Development and Training Act funds not only produce trained operators but also serve to enable persons classified as unemployed or under-employed to obtain better jobs and participate more fully in the economic life of the Nation. FWQA is further developing this approach through the Department of Defense's "Project Transition" which affords an opportunity to attract returning servicemen into the pollution control field. The "Project Transition" program provides enlisted military personnel with training for civilian jobs during their last six months of duty. Training is funded by the Manpower Development and Training Act and is administered by the Departments of Defense, Labor, and Health, Education and Welfare. FWQA is currently developing a pilot program to provide entry-level training in wastewater treatment plant operations for approximately 300 servicemen at Forts Belvoir, Virginia; Bragg, South Carolina; Hood and Bliss, Texas; and at the El Toro Marine Air Base in California. FWQA will use information gathered through a variety of programs to assist successful trainees in obtaining jobs across the country in waste treatment plants seeking qualified personnel.

We are moving forward in a number of other ways to upgrade operator training. Correspondence courses may prove the most practical method of reaching many operators of one-man plants—of which there are thousands. By late 1970 or early 1971 FWQA expects to have three correspondence courses available to help meet this need. The University of Michigan, under an FWQA grant, has developed a course utilizing programmed learning on chemistry of water and wastes for operators and technicians. Within FWQA's own short-term training teaching staff, a course on membrane filter methods in water microbiology has been developed. It will be aimed at operators. Under another grant, Sacramento State College has developed a course for improving the skills of operators in small and remote plants.

Efforts are also underway to better prepare those who will be responsible for training operators. FWQA developed and first offered a short-term training course for instructor development in April 1969. We co-sponsored with Clemson University the first large-scale national conference on operator training in Atlanta in November, 1969. This first-of-its kind meeting provided a forum for operator-trainers to meet together and listen to and discuss presentations on the latest instructional methods and teaching aids.

The President's February 4 Executive Order on control of Federally-caused pollution has established a vastly increased responsibility for FWQA to assist other Federal agencies in training operators of plants at Federal installations. The order requires Federal operators to meet levels of proficiency consistent with those being required of operators at the community level. To assist the Federal agencies, we will provide increased training opportunities, using FWQA training facilities and staff to present selective offerings of practical courses in waste treatment plant operation, methods and procedure—both for Federal operators and for personnel engaged in training Federal operators. This program will also provide FWQA with an opportunity to develop and test training techniques and materials which will ultimately be passed on to State and local governments for use in training large numbers of operators.

Enactment of the Water Quality Improvement Act of 1970 will further strengthen FWQA's activities and programs in training treatment plant operators. The new legislation authorizes a combination of grant, contract, and scholarship programs to attract and prepare students for careers in the design, operation and maintenance of waste treatment plants. Planning for implementation of new activities and approaches under this legislation is now underway.

In summary, FWQA is very substantially accelerating its training efforts, in concert with State, local and Federal agencies, with universities, and with others concerned. More effective manpower planning is needed to guide these efforts.

Trained operators are needed to assure more efficient waste treatment.

FWQA's last overall study of manpower needs, *Manpower and Training Needs in Water Pollution Control,* was submitted to the Congress in 1967. A much more specific appraisal of where and when job vacancies will occur and how they may best be met is now required. In 1969, FWQA initiated development of a manpower planning system which, when implemented, will define manpower demands, manpower supplies, and criteria for judging whether manpower resources are being effectively utilized. The system will provide carefully developed estimates of the total manpower needs in the water pollution control field and improve the identification of particularly severe manpower shortages. The system will also include more precise definition of occupations, manpower staffing guides, work force profiles, and industrial planners.

This manpower planning system will enable FWQA to formulate better action plans, through understanding the timing and nature of State, local, industrial and academic training needs. Rapid and effective implementation of this system will be needed to help us meet the training provisions of the Water Quality Improvement Act of 1970.

INTERNATIONAL ACTIVITIES

Public concern for environmental quality has reached international proportions in the last few years, and President Nixon has advanced the participation of the United States in efforts to solve global pollution problems.

The Federal Water Quality Administration (FWQA) is active on several major fronts of international activity in the environmental field. Efforts are moving ahead to meet the increasing pressures for an international leadership role in the environmental quality area.

The United States shares the North American continent with Canada and Mexico. A significant part of the water resources of the continent crosses or forms a part of the political boundaries between the United States and its two neighbors. This is especially true along the Canadian boundary where the Great Lakes system, constituting the largest source of fresh water in the world, is shared equally.

An important part of FWQA's involvement in international activities is the provision of technical support to the International Joint Commission (IJC). The latter was established pursuant to the Boundary Waters Treaty of 1909 between the United States and Canada. This activity includes membership on a number of international technical advisory boards which have been established by the IJC to investigate and report on specific boundary water problems referred to the Commission by the Governments of the two countries. At the present time, there are seven technical advisory boards working on the pollution problems of Lake Erie, Lake Ontario, the international section of the St. Lawrence River, St. Croix River (Maine), Niagara River, Detroit River, St. Clair River, St. Marys River, and Rainy River of the North.

Because of the serious acceleration of pollution in the highly industrialized areas of the Great Lakes, the work of the IJC and its advisory boards has assumed an increasingly important role in coordinating the remedial programs being carried on in the two countries to abate pollution. This coordination has resulted in significant agreement on the present levels of pollution in Lake Erie and Lake Ontario, the sources and amounts of pollutants reaching the Lakes and recommendations for an abatement program. In recent weeks, a comprehensive report on these agreements has been submitted to the IJC by its technical advisory board.

Other programs being coordinated through the IJC are oil contingency planning for boundary waters, vessel pollution control and review of off-shore drilling practices. In addition, the meeting of water pollution control technicians of the United States and Canada on boundary water problems has resulted in increasing cooperation in several areas which have not been referred to the IJC for consideration, such as Arctic pollution, exchange of scientific information, participation in pollution seminars and consultation on handling of oil spills.

Within the last year, meetings between higher levels of administrative personnel on matters of policy have developed as a result of the complexity of the pollution problems of the Great Lakes. Meetings were held between Secretary Hickel and Assistant Secretary Klein and their counterparts from Canada. As a result, the governments of both countries are moving closer together in a coordinated approach to pollution abatement in the Great Lakes. Additional meetings are being planned for FY 1970–71 involving White House level officials of the United States Government.

Although a Water and Boundary Treaty was established between the United States and Mexico in 1944, it contains no provision for formal institutions for dealing with pollution problems as is contained in the treaty with Canada. However, informal arrangements are established with the Water and Boundary Commission, and the FWQA does provide consultative services on border pollution problems when requested. Consultative services have been provided on border pollution problems stemming from domestic wastes in the Brownsville-Matamoros, El Paso-Juarez, Nogales, Yuma-Mexicali and Tijuana areas.

As the world's technicians turn to the task of controlling pollution of global waters, the development of a reliable mechanism for the exchange of existing and developing scientific information becomes increasingly necessary. As a result of this need the United States has established or explored bilateral agreements with other countries to exchange technical knowledge on water pollution control and research. Such agreements have been in operation with Germany and Japan for several years. Agreements to develop bilateral exchanges are presently being negotiated with the Soviet Union, France and Czechoslovakia. Requests for such agreements have been received from Sweden, the United Kingdom, Iceland, Poland and Romania. In negotiating these agreements, consideration is being given to including cooperation in specific research projects in problem areas of mutual interest, such as sludge disposal, the effects of pollution on fish and aquatic life, eutrophication of lakes, effluent standards and user charges.

The effect of detergent phosphate on the environment has been a matter of public and scientific discussion for several years and has recently come to the front as a major issue in the problem of accelerating lake eutrophication. As a result of the shared concern over the nutrient enrichment of Lake Erie, a joint United States-Canada team of scientists undertook a mission to Sweden in January, 1970, to investigate and study the use of low phosphate-content detergents in that country. Their findings will contribute to the development of policies for phosphate reduction in both nations.

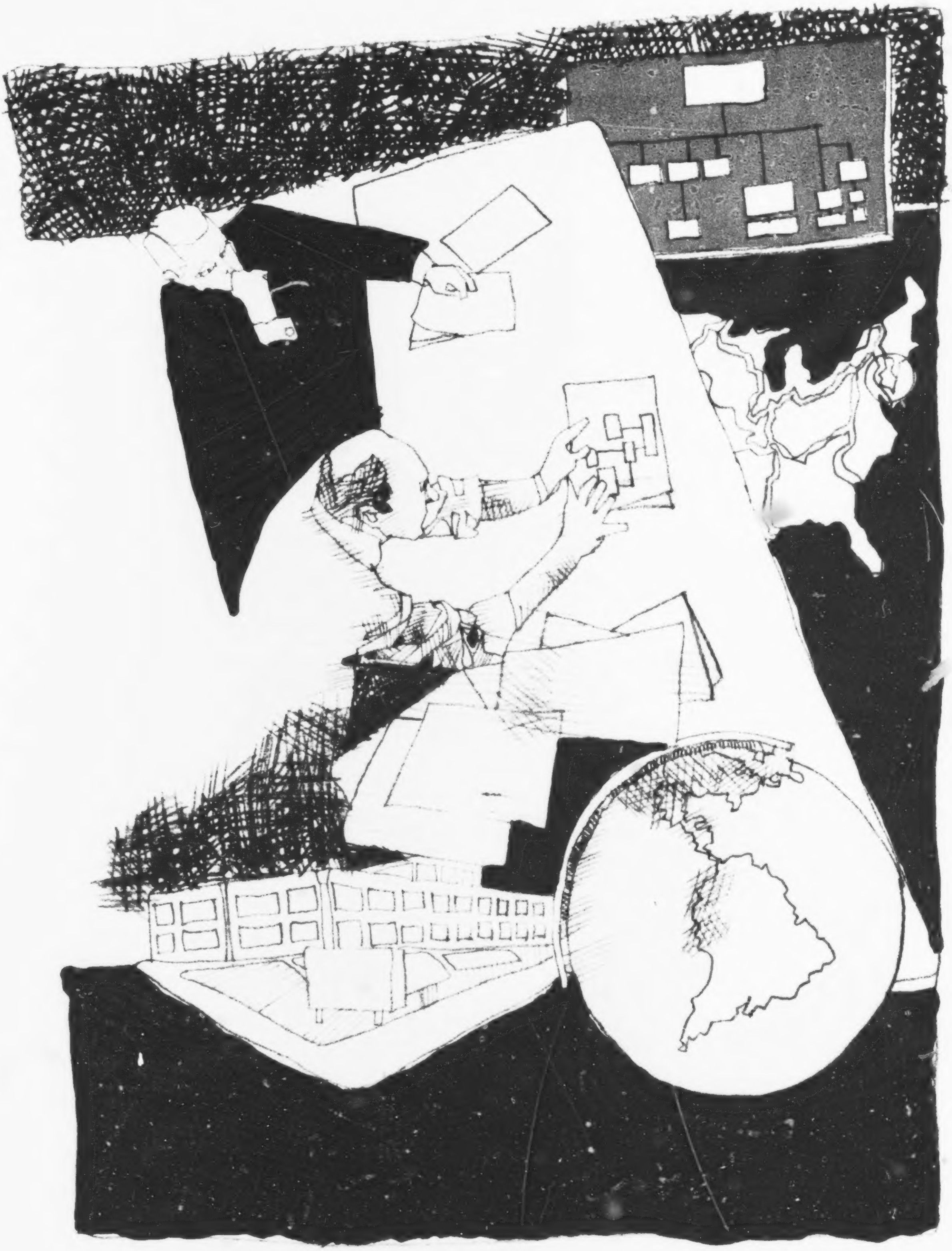
During the past year, over 100 foreign water pollution technicians and scientists have visted the United States to study control programs and techniques which have been instituted in this country. A number of these visitors have participated in the short technical training courses offered in the FWQA Regional laboratories on various aspects of water pollution control technology. This represents a sharp increase over previous years and indications are that the number can be expected to double in the next 12 to 24 months. This increased number of foreign visitors is also expected to include higher-level government administrative officials than in past years.

With the establishment by President Nixon of the Environmental Quality Council and the concurrent structuring within the Department of State of an Office of Environmental Affairs, the Administration is gearing to meet increasing responsibilities in the international area. Most, if not all, of the international, multi-lateral organizations in the free world today are in some way engaged in carrying out programs in environmental protection. These programs consist mainly of establishing procedures and organizational arrangements for the exchange of technical and scientific information and of providing a platform for the discussion between government officials of member countries on environmental problems of general concern.

In recent months, however, increasing attention has been given to the development of international policies for environmental protection. Many international conferences and symposiums are scheduled for the next 12 to 24 months, including the international Water Pollution Control Research Conference in San Francisco in September 1970; the Environmental Safety Conference in 1971 in Prague, Czechoslovakia, sponsored by the Economic Commission for Europe; and the UN's major effort in this field in 1972 in Sweden. The conference will bring together the world's leading scientists and political leaders to discuss the environmental problems that beset the world.

FWQA has provided an increasing number of its technical and top administrative personnel to support these developing activities. This includes the appointment of agency representatives to environmental technical and planning panels which have been established in the North Atlantic Treaty Organization framework, the Economic Commission for Europe, the Organization for Economic and Cultural Development, and others. Co-sponsorship of the biennial International Congress on Water Pollution Research is a major undertaking of FWQA, and the Agency will be active in the planning and conduct of the next conference to be held in San Francisco in September, 1970.

The involvement of FWQA in the international field has been relatively small in the past and restricted to specialized technical fields. But sudden world concern for protection of the environment will thrust upon us an increasing pressure to share our knowledge, progress and technical capability with all Nations. This is especially true if the United States is to continue its present role as a leader in the free world.



ORGANIZATION, RESOURCES, AND FACILITIES

The capability of any agency to accomplish its mission is dependent upon its resources—budget, staff, and facilities—and upon how effectively those resources are organized and managed. During the past year, substantial efforts have been directed towards the improved organization and management of Federal Water Quality Administration (FWQA).

Major improvements have been made in FWQA's personnel systems and organization structure. Added emphasis is being given to systematic work planning—competing demands on the Agency's resources have made of prime importance the identification and maintenance of priorities, schedules, and objectives to guide our work. An Agency-wide accounting and management information system will be operational by July 1, 1970. This system will generate electronic data programs and develop reports which will aid top management in their decision-making process.

A formal directives system has been established to assure rapid and accurate communication of policy and instructions throughout the Agency. Better systems of delegation of authority and other management improvements are currently underway.

FWQA's mission is an increasingly complex one, and constant attention to modern management methods is an essential part of its overall job.

Organization

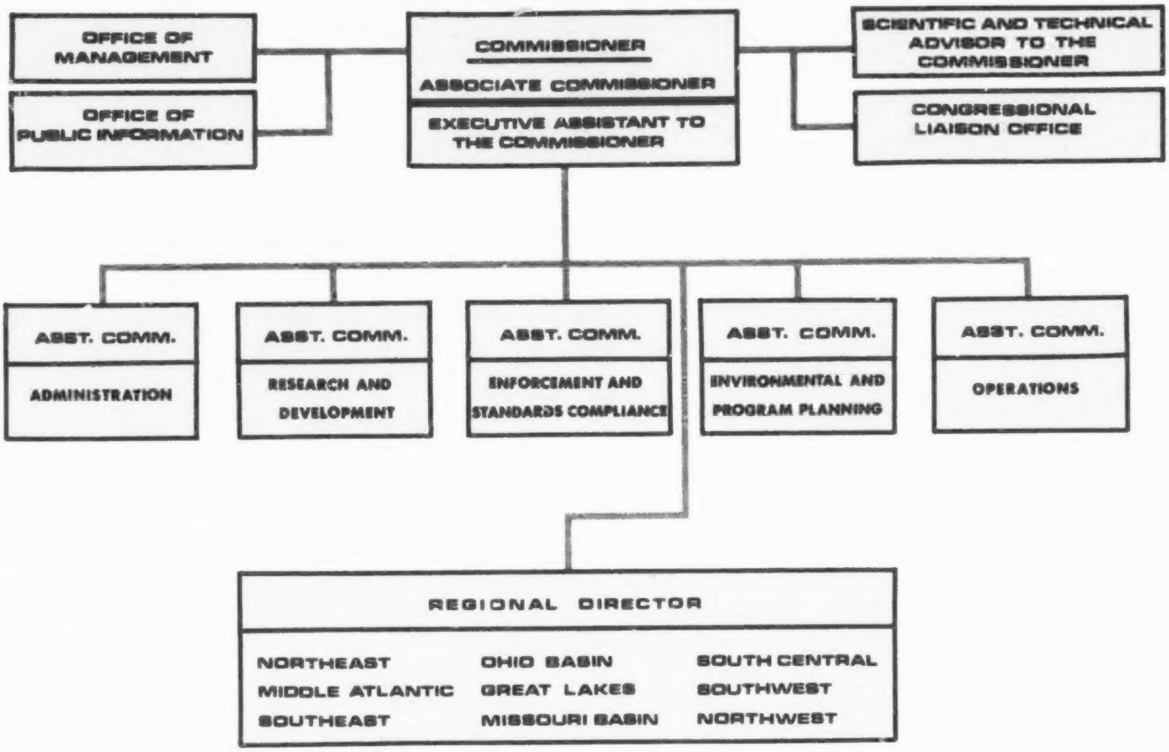
FWQA is organized along functional lines, as outlined on the attached organization chart.

During the past years, there have been a number of changes in FWQA's organizational structure, at both Headquarters and field levels, designed to marshall the Agency's resources most effectively to meet its changing mission.

With increasing emphasis placed on securing compliance with established water quality standards, the standards function has been transferred from the jurisdiction of the Assistant Commissioner for Operations to the jurisdiction of the Assistant Commissioner for Enforcement. The current emphasis on the environment as a whole is reflected by the proposed creation of the position of Assistant Commissioner for Environmental and Program Planning. The passage of the Water Quality Improvement Act of 1970 prompted the creation and staffing of an Office of Oil and Hazardous Materials.

The bulk of FWQA's activities is in the field. Of a present staff of 2,538 permanent and temporary employees, 592 are located in Headquarters, and 1,946 are assigned to the nine

FEDERAL WATER QUALITY ADMINISTRATION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OFFICE OF PUBLIC INFORMATION
COMMISSIONER
ASSOCIATE COMMISSIONER
EXECUTIVE ASSISTANT TO THE COMMISSIONER
SCIENTIFIC AND TECHNICAL ADVISOR TO THE COMMISSIONER
CONGRESSIONAL LIAISON OFFICE
ASST. COMM.
ADMINISTRATION
ASST. COMM.
RESEARCH AND DEVELOPMENT
ASST. COMM.
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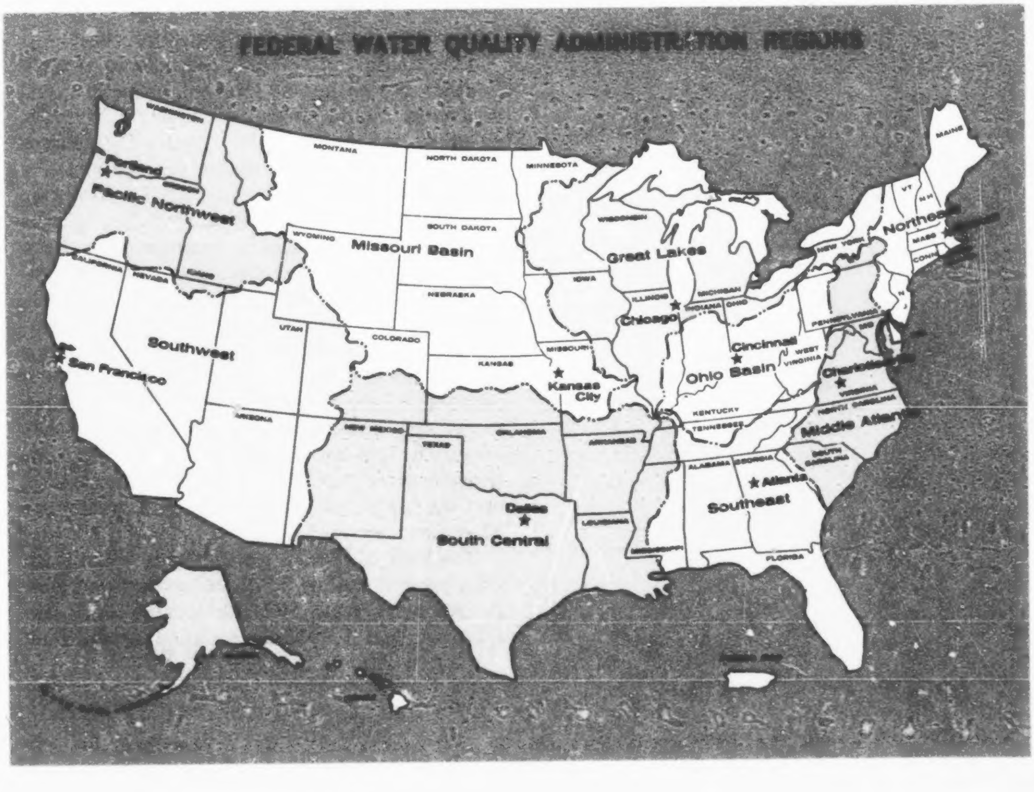
FEDERAL WATER QUALITY ADMINISTRATION REGIONS
Portland
Pacific Northwest
Missouri Basin
Great Lakes
Northeast
Chicago
Cincinnati
Ohio Basin
Kansas City
Southwest
San Francisco
Charlottesville
Middle Atlantic
Atlanta
Southeast
Dallas
South Central

Regions. Regional boundaries are outlined on the attached map.

FWQA's Regions are organized along hydrologic lines to facilitate the planning and implementation of the clean-up of entire river basins and to aid our work with related water resource agencies. This method of organization is considered most effective in terms of the Agency's current program operations. It sometimes creates difficulties, however, for States whose boundaries fall within more than one Region. With the increased emphasis on effective working relationships with the States, major attention is being given to adjustments in responsibilities and lines of communication which will ease these problems.

The Department of the Interior's participation in the President's Federal Activities Review Program, which is designed to assure that services to State and local government are of maximum effectiveness, may lead to further adjustments in our Regional structure.

Personnel

FWQA's most valuable resource is its staff —a staff comprised of dedicated and experienced professionals, with backgrounds representing the many disciplines needed to operate an effective governmental agency. Heavily represented on the staff, because of the nature of the Agency's mission, are scientists and engineers with specialized experience in water pollution control, oceanography, and related fields. Lawyers, economists, public administrators, regional planners, and others provide the needed balance of skills.

A major management improvement during the past year has been initiation of an Agency career development system, designed to provide for planned intake of college graduates in entrance level positions; training and development for each careerist; a career counseling and appraisal system; and a centralized bank of data on all employees in an occupational field. This system will cover all scientific and engineering, technical support and administrative personnel by June 30, 1970. The Career Planning System will enable management to obtain, develop and retain a highly qualified workforce to meet mission goals and objectives in a timely and economical manner.

In addition to this system, a Graduate Fellowship Program was developed to provide a system to hire top quality graduate students who have completed all requirements for their advance degree but the thesis. They are hired on temporary appointments for one year and work on a special project selected by FWQA which can serve as the basis for their thesis. These employees form a pool of outstanding candidates for future employment with FWQA on a permanent basis.

Further in-house personnel management improvements were made by the implementation of a personnel program evaluation and management advisory service designed to measure the effectiveness of personnel management policies, practices and procedures. Lengthy interviews with managers at all levels, non-supervisory attitude questionnaire sessions, and discussions with Personnel Office staff members have provided the data for evaluation. At the conclusions of each survey, a report is made to management containing action items or recommendations for improving working conditions, employee morale, and supervisory performance.

Another innovation is the automated personnel system which results in statistical reports prepared by computer which greatly reduces the amount of time spent on this function at all levels of management. It also provides management with instant feedback of data needed for planning and other purposes. By the end of FY 1971, it is anticipated that all employee training records including FWQA-wide training needs will be fully automated. Also, the skills inventory file will be converted to an automated data bank to enable the instantaneous referral of outstanding candidates for vacant positions and to provide data needed for the manpower planning function.

Facilities

In addition to its Headquarters and Regional Office locations, FWQA conducts its work at 46 field stations and laboratories located in the field. These facilities range from complex laboratories, designed and operated to conduct sophisticated research, to small field stations, studying special problems. A variety of physical facilities is needed. At the Southeast Water Laboratory on the University of Georgia campus at Athens, controlled environmental chambers, designed to simulate varying conditions in the natural environment, have been constructed. Work with these chambers is shedding new light on basic pollution relationships in streams. In Newtown, Ohio, an entire tributary has been protected and controlled with weirs and other devices to test the long-term effects of low level toxic wastes on biota under natural conditions. This unique facility has already attracted the attention of scientists across the Nation. A small laboratory on a floating barge provides a

Scientists in FWQA laboratories conduct research on pollution and its effects on aquatic life.

base for a team of investigators studying pollution along the Florida coast. The National Water Quality Laboratory at Duluth, Minnesota, provides special facilities to conduct a wide range of studies designed to determine environmental requirements of fresh water organisms.

During the past year, the Bears Bluff Laboratory on the South Carolina coast was leased to FWQA by a non-profit educational institution. This facility will provide an invaluable opportunity to conduct work on environmental requirements of southern waters marine life—an important need in the establishment of improved water quality criteria.

Currently, FWQA is completing a comprehensive review of the need for additional facilities. A 5-year proposed facilities program has been developed. It is designed to provide necessary facilities and laboratory space for the future.

Budgetary Resources

FWQA's budgetary resources for the past, current and coming fiscal years are shown below. These figures show a significant increase for water pollution control, reflecting the high priority this program is receiving from the President and Congress during a period of overall budgetary stringency.

Appropriations to Federal Water Quality Administration (in thousands of dollars)

	FY 1969	FY 1970	1971 President's Budget
Research, development and demonstration	$43,611	$37,260	$44,092
Comprehensive planning			
Federal planning studies	4,936	5,214	5,143
Planning grants	1,250	1,782	2,900
Control of Pollution from Federal activities	858	1,031	1,158
Technical support	5,732	6,181	6,188
Pollution surveillance	2,690	4,012	4,286
Training			
Federal activities	1,274	1,573	1,801
Training grants	4,000	4,620	5,250
State and interstate program grants			
Grants	10,000	10,000	10,000
Grants administration	329	344	394
Construction grants for waste treatment works			
Grants	214,000	800,000	*
Grants administration	2,674	4,198	5,883
Enforcement	4,042	4,381	5,256
Executive direction and support	5,279	5,528	5,667
Total, new obligational authority	300,675	*886,124	**98,018

*For 1971, $4 billion is provided in proposed legislation which would provide contract authority for use over four years for grants to localities for construction of waste treatment works, of which $1 billion will be allocated in 1971 and in each of the next three fiscal years.

*Amounts shown exclude any consideration for Water Quality Improvement Act of 1970.

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U.S. DEPARTMENT OF THE INTERIOR

CLEAN
WATER

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BIOLOGICAL SURVEY OF ROCK CREEK FROM ROCKVILLE, MARYLAND TO THE POTOMAC RIVER

Federal Water Pollution Control Administration
Charlottesville, Virginia

October 1966

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TABLE OF CONTENTS

Section | Page

I. INTRODUCTION 1

II. SUMMARY AND CONCLUSIONS 3

III. DATA EVALUATION AND INTERPRETATION 5

LIST OF TABLES

Table | Page

I Bottom Organism Data of Rock Creek and Tributaries 13

LIST OF FIGURES

Figure | Follows Page

1 Map of Study Area and Profile of Biological Conditions on Rock Creek 14

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I. INTRODUCTION

A biological survey of Rock Creek, a tributary of the Potomac River, was conducted in August 1966. The survey was made to determine the biological condition of the stream from north of Rockville, Maryland, to the mouth of the stream in Washington, D. C. (See Figure 1, following page 14.)

For purposes of the study, the community of bottom (benthic) organisms was selected as the indicator of the biological condition of the stream. Bottom organisms serve as the preferred food source for the higher aquatic forms and exhibit similar reactions to adverse stream conditions. The combination of limited locomotion and life cycles of one year or more, for most benthic species, provide a long-term picture of the water quality of a stream. Fish and algal populations were given some consideration, but only to the extent that obvious conclusions could be drawn based upon casual observations.

In unpolluted streams, a wide variety of sensitive clean-water associated bottom organisms are normally found. Typical groups are stoneflies, mayflies, and caddisflies. These sensitive organisms usually are not individually abundant because of natural predation and competition for food and space; however, the total count or number of organisms at a given station may be high because of the number of different varieties present.

Sensitive genera tend to be eliminated by adverse environmental conditions (e.g., chemical and/or physical) resulting from wastes reaching the stream. In waters enriched with organic wastes, comparatively fewer kinds (genera) are normally found, but great numbers of these genera may be present. Organic pollution-tolerant forms such as sludgeworms, rattailed maggots, certain species of bloodworms (red midges), certain leeches, and some species of air-breathing snails may multiply and become abundant because of a favorable habitat and food supply. These organic pollution-tolerant bottom organisms may also exist in the natural environment but are generally found in small numbers. The abundance of these forms in streams heavily polluted with organics is due to their physiological and morphological abilities to survive environmental conditions more adverse than conditions that may be tolerated by other organisms. Under conditions where inert silts or organic sludges blanket the stream bottom, the natural home of bottom organisms is destroyed, causing a reduction in the number of kinds of organisms present.

In addition to sensitive and pollution-tolerant forms, some bottom organisms may be termed intermediates, in that they are capable of living in fairly heavily polluted areas as well as in clean-water situations. These organisms occurring in limited numbers, therefore, cannot serve as effective indicators of water quality.

II. SUMMARY AND CONCLUSIONS

1. A biological survey of Rock Creek and tributaries from north of Rockville, Maryland, to the Potomac River in Washington, D. C., was conducted in August 1966. Investigations were made at 16 stations on Rock Creek and at four stations on tributaries.

2. Bottom organisms were selected as the primary indicator of biological water quality.

3. From Avery, Maryland, to the small tributary east of Rockville, Maryland, an abundance of minnows and clean-water bottom organisms indicated good water quality. From the tributary to Viers Mill Village, some degradation of water quality was noted, but indicated water quality was generally good.

4. Trash and degraded aquatic life were observed at Viers Mill Village, indicating fair water quality.

5. Improved aquatic life, indicating good water quality, was found from Garret Park, Maryland, to North Chevy Chase, Maryland.

6. Evidence of pollution increased as the Rock Creek Survey continued downstream to the Potomac. Coquelin Creek contributed nitrogen and phosphorus, and Piney Branch contributed a mild organic pollution load to the stream. Sparse clean-water genera at Rock Creek Recreation Center indicated fair water quality, while intermediate and pollution-tolerant genera in the reach from Beach Drive to P Street indicated mild pollution.

7. Slash Run and P Street outfall sewers were contributing organic pollution to Rock Creek. Moderate to heavy pollution was indicated from P Street to the Potomac River. Dominant bottom organisms consisted of intermediate and pollution-tolerant genera. Only one bottom organism was found at the mouth of Rock Creek. Tidal action diffuses salt water into the mouth of the stream, which probably accounted for the low population of bottom organisms in the area.

III. DATA EVALUATION AND INTERPRETATION

Rock Creek is a small, scenic stream flowing southeast from north of Rockville in Montgomery County, Maryland, and discharging into the Potomac River in Washington, D. C. Bridle paths, picnic and recreation areas, and the National Zoological Park are among the facilities along the banks of the stream.

Storm sewers discharge into the stream at various points, but no sanitary or industrial sewers discharge directly into the stream upstream from P Street in Washington, D. C.

Sampling stations were located after consideration of the following conditions:

1. Tributaries
2. Areas having a known waste problem
3. Physical capability for sampling.

Bottom organisms are animals that live directly in association with the bottom of a waterway. They may crawl on, burrow in, or attach themselves to the bottom. Macroorganisms are usually defined as those organisms that will be retained by a No. 30 sieve. In essence, the organisms retained by the sieve are those that are visible to the unaided eye.

Each station was sampled once, and the kinds of macro bottom organisms were observed for the purpose of evaluating water quality. Quantitative bottom samples were also taken, using a Surber Square Foot Sampler, and the number of organisms per square foot was counted.

Quantitative samples were not taken at stations in non-critical areas or where organisms were very sparse.

Discussions of stations proceed downstream unless otherwise noted.

Station #1 - Rock Creek at Avery Road Bridge north of Rockville, Maryland

The water at this station was clear, and numerous minnows were observed throughout the area. A total of nine genera of bottom organisms were found, including such clean-water forms as mayflies (two genera), caddisflies, and fishflies. Good water quality was indicated based on the bottom organisms.

Station #2 - Rock Creek, East Branch at Route 115 Bridge, north of Rockville, Maryland

Very clear water and numerous minnows were observed in this area. A total of 17 different genera of bottom organisms were collected and included such clean-water forms as stoneflies, mayflies (three genera), caddisflies (two genera), fishflies, and riffle beetles. A total of 109 bottom organisms were collected in the square foot sample, which included 35 caddisflies, 20 mayflies, 15 riffle beetles, and four fishflies. Excellent water quality was indicated.

Station #3 - Rock Creek tributary at Avery Road, east of Rockville, Maryland

A sparse population of four genera of bottom organisms was found in this tributary, mayflies and caddisflies being the dominant organisms. Fair water quality was indicated.

Station #4 - Rock Creek at Route 28 Bridge, East of Rockville, Maryland

A total of 16 genera of bottom organisms were sampled at this station and included such clean-water forms as mayflies, caddisflies (two genera), fishflies, and riffle beetles. The water was somewhat murky, but small schools of minnows could be observed. Only 35 bottom organisms were collected in the square foot sample, with fingernail clams (an intermediate) being the dominant form with 15 in number. Good water quality was indicated.

Station #5 - Rock Creek upstream from Randolph Road at Viers Mill Village, Maryland

Cloudy water, abundant trash, and sparse bottom organisms were noted at this station. Only one clean-water caddisfly was among the four bottom organisms found; the balance consisted of two intermediate genera and a pollution-tolerant form. Fair water quality was indicated.

Station #6 - Rock Creek at Route 547 Bridge, Garrett Park, Maryland

The water was clear, and small schools of minnows were observed at this station. Bottom organisms were not abundant, and only five genera were sampled. The sample, however, included such clean-water forms as mayflies (two genera) and caddisflies. Good water quality was indicated.

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Station #7 - Rock Creek at Beach Drive and Cedar Lane, Kensington, Maryland

Exceptionally clear water, numerous minnows, and ten different genera of bottom organisms were found at this station. Included in the sample were such clean-water forms as mayflies (two genera) and caddisflies (two genera). A total of 224 bottom organisms were collected in the square foot sample, which included 27 mayflies and three caddisflies. The dominant form was an intermediate midge larva which made up 190 of the total count. Good water quality was indicated.

Station #8 - Rock Creek at Jones Mill Road, Chevy Chase, Maryland

At this station the water was again exceptionally clear, and numerous small minnows were observed. Only three genera of bottom organisms were found, but they consisted mainly of two genera of caddisfly larvae. Good water quality was indicated.

Station #9 - Coquelin Creek at Jones Mill Road Bridge, North Chevy Chase, Maryland

On this small tributary to Rock Creek, the water was clear, but the filamentous algae was heavy in much of the area, suggesting excessive nitrogen and phosphorus. Oil slicks arose when some of the bottom was stirred up by wading. A total of 12 genera of bottom organisms was found and included a fair population of mayflies and caddisflies. Blackflies were the dominant organism and made up 155 of the 192 organisms in the square foot sample. Only fair water quality was indicated.

Station #10 - Rock Creek at East-West Highway 410, Rock Creek Recreation Center, Maryland

Clear water and minnows were observed in this area. A total of ten genera was found, but bottom organisms were generally sparse. A small population of mayflies, consisting of only 23 organisms, was collected in the square foot sample. Fair water quality was indicated.

Station #11 - Rock Creek at Wise Road and West Beach Drive, Washington, D. C.

Only three genera of bottom organisms, consisting of two pollution-tolerant genera and one intermediate genera, were sampled at this station. Bottom organisms were sparse, and a quantitative sample was not taken. About 20 yards downstream, a large storm sewer empties from the left bank (facing downstream). The bottom in this channel appeared to be coated with oil, and oil slicks came to the surface when the bottom was disturbed. Mild pollution is suggested in this area.

Station #12 - Rock Creek at Military Road, Washington, D. C.

This station was located at a roadside park. Five genera of bottom organisms were found, consisting of three organic pollution-tolerant genera and two intermediate forms. Generally, bottom organisms were sparse. A small tributary comes in from the left bank a short distance downstream. This tributary was very heavy with filamentous algae, suggesting high nitrogen and phosphorus. Mild organic pollution is suggested.

Station #13 - Rock Creek at Park Road Bridge, Washington, D. C.

The water was clear, and small schools of minnows were observed in the area. Eight genera of bottom organisms were sampled, consisting of four organic pollution-tolerant and four intermediate forms. Bottom organisms were not abundant; only 27 were collected in the square foot sample. Mild organic pollution is suggested.

Station #14 - Piney Branch at Park Road Bridge, Washington, D. C.

In this tributary to Rock Creek, the water was clear, but filamentous algae was extremely abundant on the rocks and gravel. Nine genera were collected, but the sample contained only one clean-water associated form (mayfly). The balance consisted of four intermediate forms and four pollution-tolerant forms. The dominant form was an intermediate midge larva, which made up 75 of the 113 bottom organisms in the square foot sample. A faint sewage odor was detected. In addition, heavy algae suggested high nitrogen and phosphorus concentrations. Piney Branch is believed to contribute a mild pollutional load to Rock Creek.

Station #15 - Rock Creek at Harvard Street Entrance to the National Zoological Park, Washington, D. C.

In this area the water was clear, but the rocks were coated with slime. Although nine genera of bottom organisms were found, only fair populations of an intermediate midge larva and a pollution-tolerant snail were sampled. The other bottom organisms were sparse.

The intermediate midge larva made up 86 of the 103 bottom organisms in the square foot sample. Mild organic pollution is suggested.

Station #16 - Rock Creek at Calvert Street Bridge, Washington, D. C.

Clear water and numerous minnows were observed at this station; however, a faint sewage odor was detected. Although ten genera of bottom organisms were found, the only clean-water associated form consisted of a few caddisfly larvae. An intermediate midge larva made up 46 of the 55 organisms collected in the square foot sample. Sludgeworms, the bloodworm midge *Chironomus*, blackflies, and two genera of pollution-tolerant snails were collected. Mild organic pollution was indicated.

Station #17 - Rock Creek upstream from P Street Outfall, Washington, D. C.

Rock Creek was sampled immediately upstream from the P Street outfall. The water was clear, and small schools of minnows and sunfish were observed upstream but not downstream from the outfall. Broken glass and trash were heavy in the stream. Six genera of bottom organisms were collected, consisting of four organic pollution-tolerant forms and two intermediate forms. The dominant forms were an intermediate midge (98) and sludgeworms (43) out of the 158 bottom organisms collected in the square foot sample. Mild organic pollution was indicated.

Station #18 - Rock Creek downstream from P Street Outfall, Washington, D. C.

This station was located approximately 25 yards downstream from the P Street outfall in Washington, D. C. A faint sewage odor was detected, and trash was observed in the stream. Only five genera of bottom organisms were found, and these consisted of four organic pollution-tolerant forms and one intermediate kind. The pollution-tolerant genera consisted of bloodworms, sludgeworms, leeches, and a pollution-tolerant snail. Moderate organic pollution was indicated.

Station #19 - Rock Creek at Slash Run Outfall, Washington, D. C.

Rock Creek was sampled downstream from the Slash Run outfall, which is downstream from the P Street outfall in Washington, D. C. The water was murky, and the sewage odor was strong. The bottom organisms consisted of three pollution-tolerant genera and two intermediate genera. The 480 organisms in the square foot sample included 390 intermediate midges and 71 sludgeworms. Moderate organic pollution is indicated at this station. The source appears to be the Slash Run sewer.

Station #20 - Rock Creek at the Potomac River, Washington, D. C.

The last station on Rock Creek was located approximately 30 yards upstream from the mouth, near the canoe rental concession. The water was very turbid, and oil slicks were stirred up by wading. After approximately 15 minutes of intensive searching, only one bloodworm could be found. A quantitative sample was not taken for this reason. Tidal action washes trash and waste into the area.

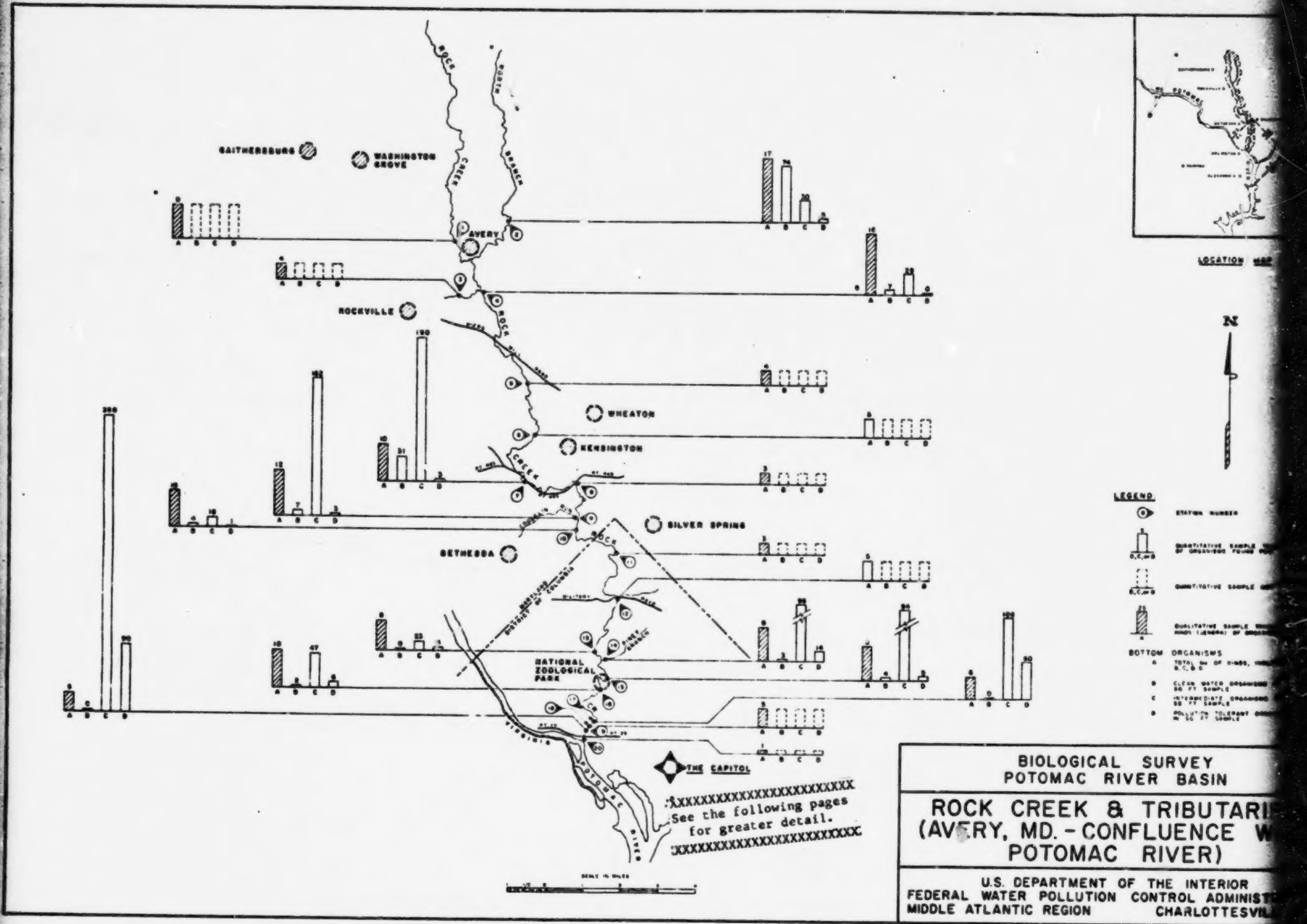
TABLE I

BOTTOM ORGANISM DATA OF ROCK CREEK AND TRIBUTARIES

Station Number	Location	Bottom Organisms No. of Kinds	 No. Per Sq. Ft.	Dominant Forms	Indicated Water Quality
1	Avery Road Bridge, Maryland	9	Not Taken	Mayflies Caddisflies	Good
2	Route 115 Bridge, Rock Creek North Branch, Maryland	17	109	Caddisflies Mayflies	Excellent
3	Tributary at Avery Road, Maryland	4	Not Taken	Mayflies Caddisflies	Fair
4	Route 28 Bridge, Maryland	16	35	Fingernail Clams	Good
5	Randolph Road, Viers Mill Village, Maryland	4	Not Taken	Intermediate Genera	Fair
6	Route 547 Bridge, Maryland	5	Not Taken	Mayflies Caddisflies	Good
7	Beach Drive and Cedar Lane, Maryland	10	224	Midge Larva Mayflies Caddisflies	Good
8	Route 495 and Jones Mill Road, Maryland	3	Not Taken	Caddisflies	Good
9	Coquelin Creek at Jones Mill Road Bridge, Maryland	12	192	Blackflies	Fair
10	Route 410 at Rock Creek Recreation Center, Maryland	10	23	Intermediate Genera	Fair
11	Wise Road and West Beach Drive, Washington, D. C.	3	Not Taken	Pollution-Tolerant Genera	Mildly Polluted

TABLE I (Continued)

Station Number	Location	Bottom Organisms No. of Kinds	 No. Per Sq. Ft.	Dominant Forms	Indicated Water Quality
12	Military Road, Washington, D. C.	5	Not Taken	Pollution-Tolerant Genera	Mildly Polluted
13	Park Road Bridge, Washington, D. C.	8	27	Intermediate and Pollution-Tolerant Genera	Mildly Polluted
14	Piney Branch at Park Road Bridge, Washington, D. C.	9	113	Midge Larva Pollution-Tolerant Genera	Mildly Polluted
15	National Zoo, Harvard Street, Washington, D. C.	9	103	Midge Larva Pollution-Tolerant Genera	Mildly Polluted
16	Calvert Street Bridge, Washington, D. C.	10	55	Midge Larva Sludgeworms Bloodworms	Mildly Polluted
17	Upstream from P Street Outfall, Washington, D. C.	6	158	Intermediate Midge Sludgeworms	Mildly Polluted
18	Downstream from P Street Outfall, Washington, D. C.	5	Not Taken	Bloodworms Sludgeworms Leeches	Moderately Polluted
19	Slash Run Outfall, Washington, D. C.	5	480	Intermediate Midge Sludgeworms	Moderately Polluted
20	Mouth of Rock Creek, Washington, D. C.	1	Not Taken	Bloodworm	Moderate to Heavy Pollution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GAITHERSBURG
WASHINGTON GROVE
AVERY
ROCKVILLE
ROCK
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WHEATON
KENSINGTON
SILVER SPRING
BETHESDA
NATIONAL ZOOLOGICAL PARK
VIRGINIA
POTOMAC RIVER
THE CAPITOL
LOCATION MAP
N
LEGEND
STATION NUMBER
QUANTITATIVE SAMPLE
QUALITATIVE SAMPLE
BOTTOM ORGANISMS
A
B
C
D
SCALE IN MILES

XXXXXXXXXXXXXXXXXXXXXXXXX
See the following pages
for greater detail.
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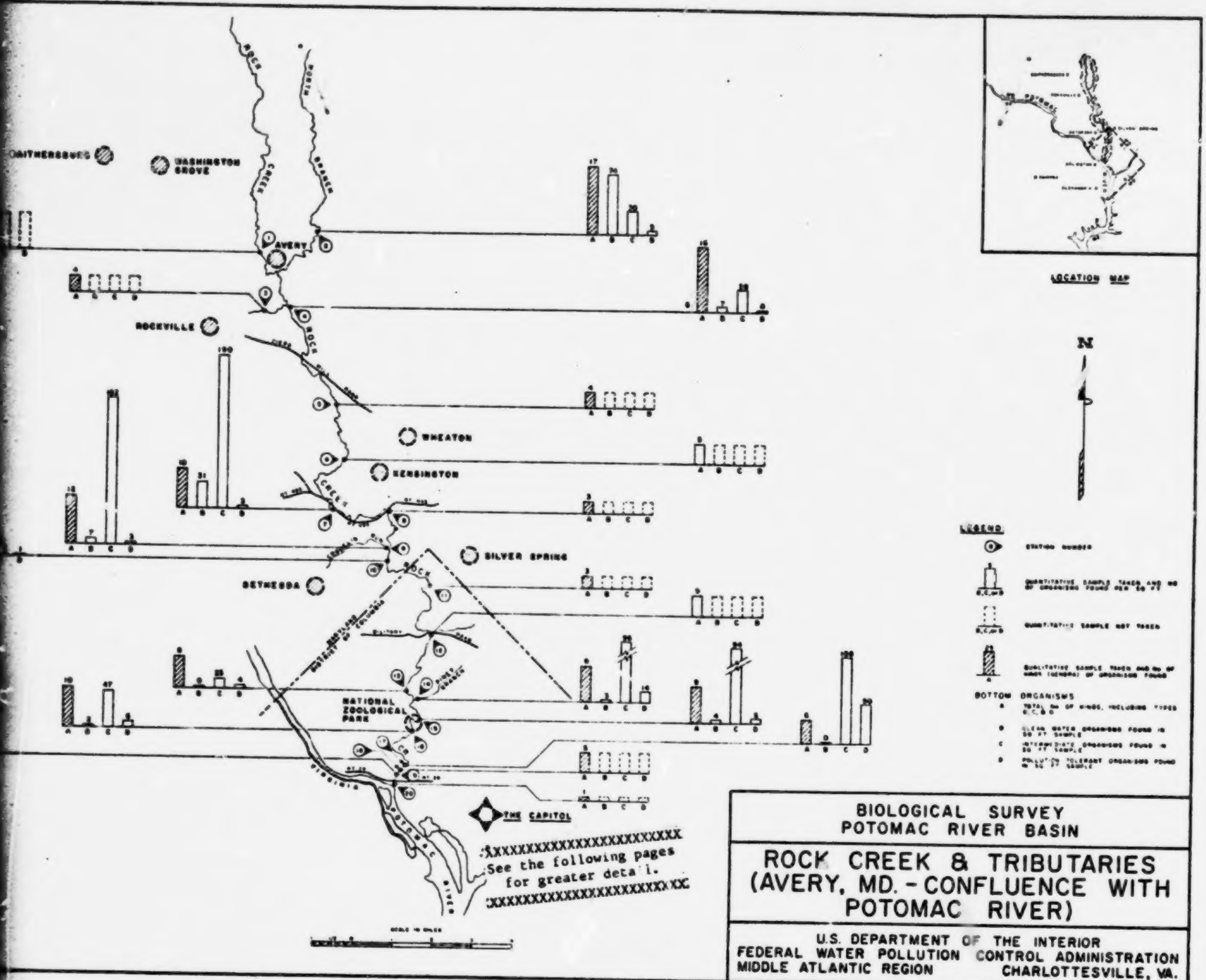
BIOLOGICAL SURVEY
POTOMAC RIVER BASIN

ROCK CREEK & TRIBUTARIE
(AVERY, MD. - CONFLUENCE W
POTOMAC RIVER)

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINIST
MIDDLE ATLANTIC REGION CHARLOTTESVIL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ROCKVILLE
WHEATON
KENSINGTON
SILVER SPRING
BETHESDA
NATIONAL ZOOLOGICAL PARK
POTOMAC RIVER
THE CAPITOL
LOCATION MAP
N
LEGEND:
STATION NUMBER
QUANTITATIVE SAMPLE TAKEN AND NO. OF ORGANISMS FOUND PER SQ FT
QUANTITATIVE SAMPLE NOT TAKEN
QUALITATIVE SAMPLE TAKEN AND No. OF KINDS (GENERA) OF ORGANISMS FOUND
BOTTOM ORGANISMS
A TOTAL No. OF KINDS, INCLUDING TYPES B, C, & D
B CLEAN WATER ORGANISMS FOUND IN SQ FT SAMPLE
C INTERMEDIATE ORGANISMS FOUND IN SQ FT SAMPLE
D POLLUTION TOLERANT ORGANISMS FOUND IN SQ FT SAMPLE
A
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D
190
SCALE IN MILES

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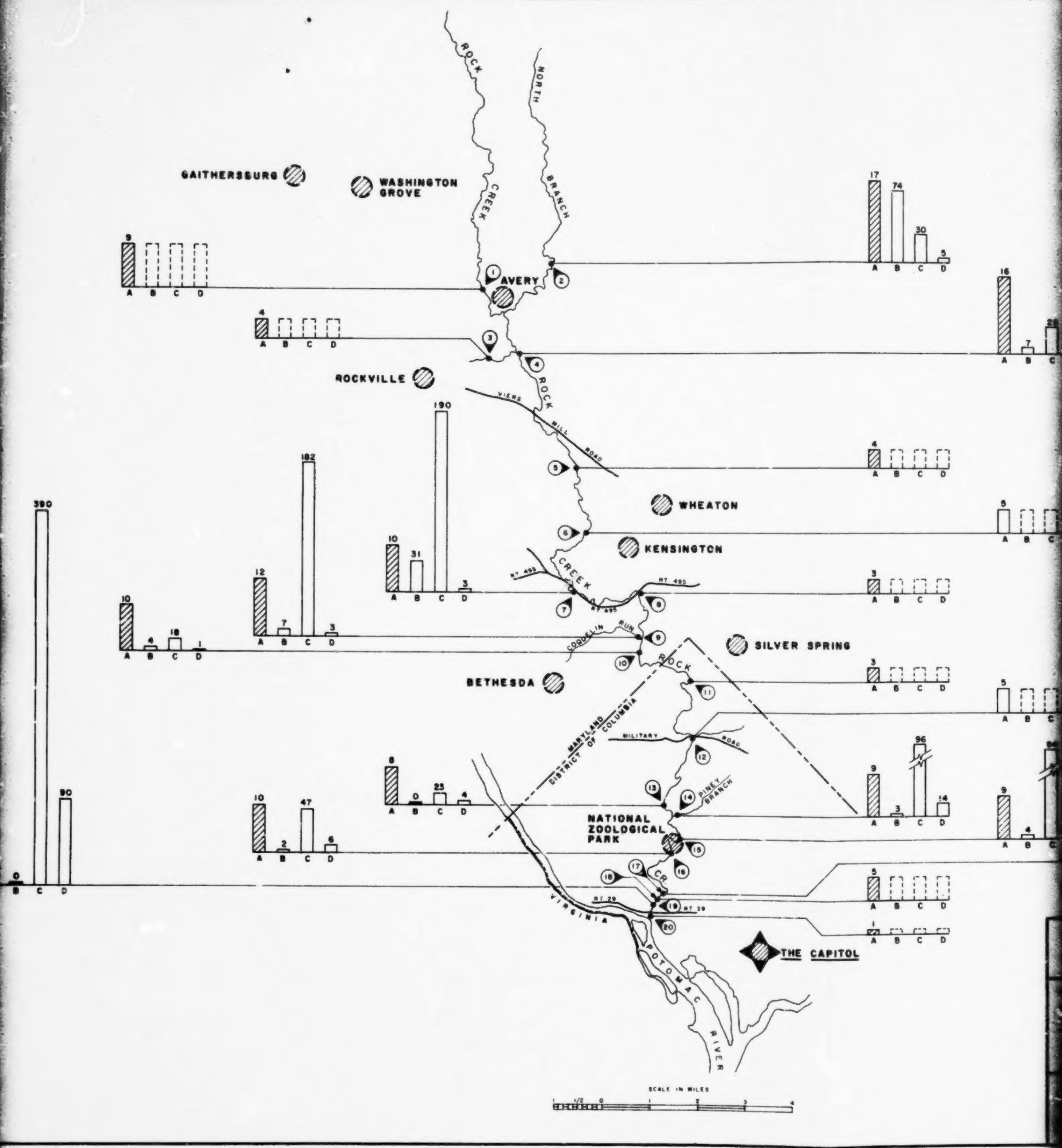
See the following pages
for greater detail.
XXXXXXXXXXXXXXXXXXXXXXXXX

BIOLOGICAL SURVEY
POTOMAC RIVER BASIN

ROCK CREEK & TRIBUTARIES (AVERY, MD. - CONFLUENCE WITH POTOMAC RIVER)

U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
MIDDLE ATLANTIC REGION CHARLOTTESVILLE, VA.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BETHESDA
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THE CAPITOL
ROCK CREEK
NORTH BRANCH
ROCK
CREEK
VIERS MILL ROAD
RT 495
COQUELIN RUN
MILITARY ROAD
PINEY BRANCH
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RT 29
MARYLAND
DISTRICT OF COLUMBIA
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POTOMAC RIVER
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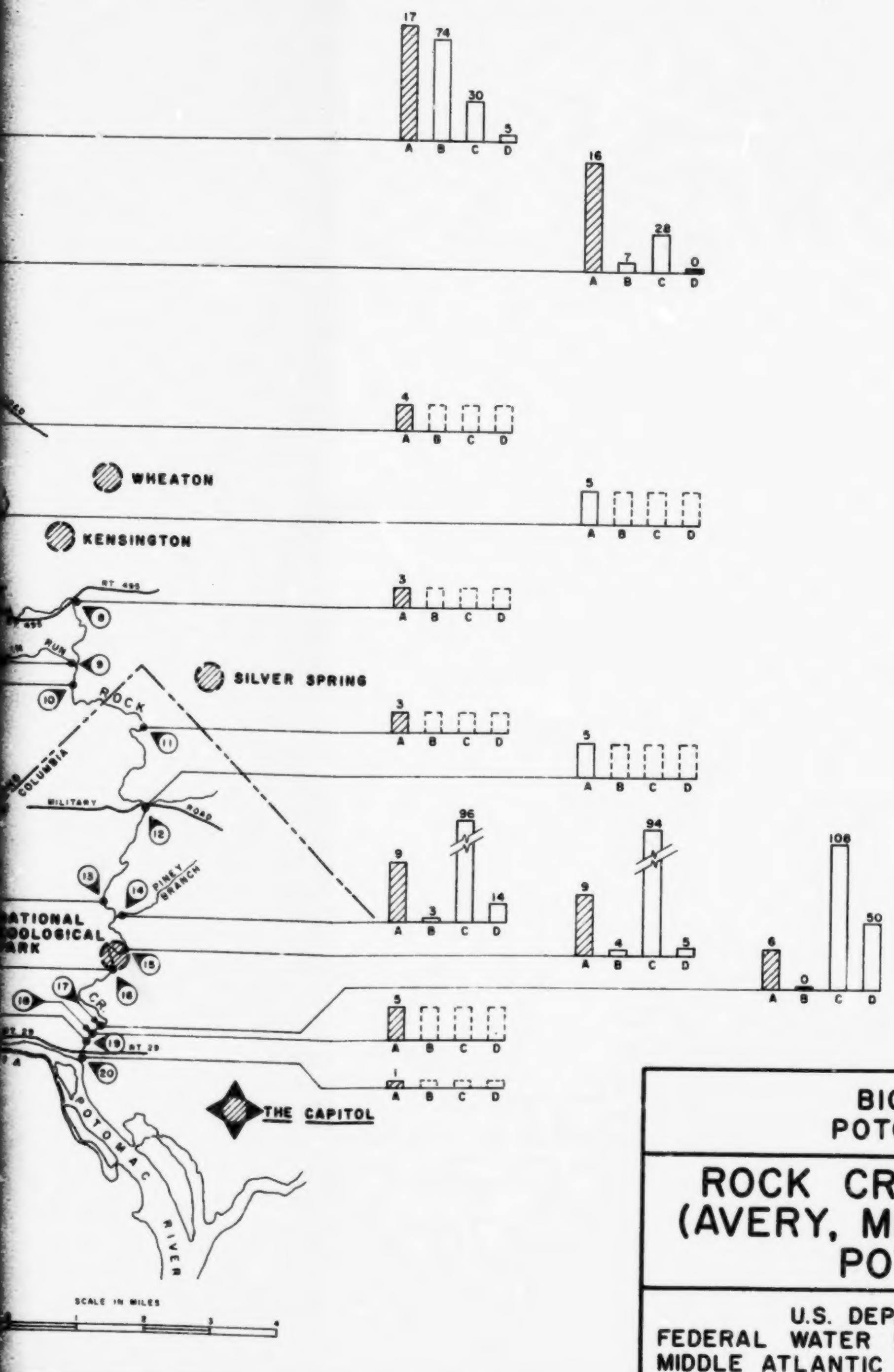
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KENSINGTON
SILVER SPRING
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ROCK
COLUMBIA
MILITARY ROAD
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POTOMAC
RIVER
THE CAPITOL
SCALE IN MILES
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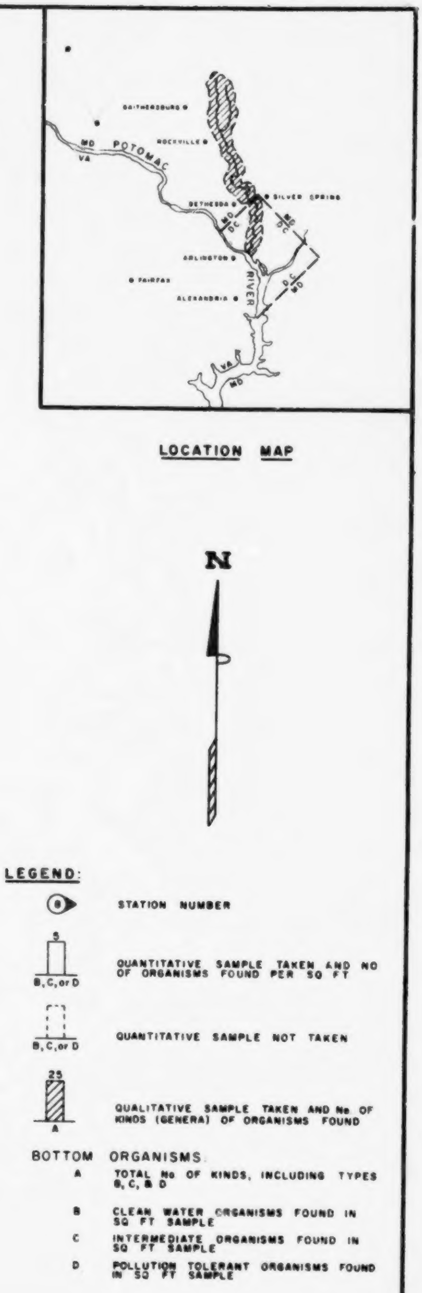
GAITHERSBURG
ROCKVILLE
MD
VA
POTOMAC
SILVER SPRING
BETHESDA
MD
DC
ARLINGTON
FAIRFAX
ALEXANDRIA
RIVER
DC
MD
VA
MD
N

LOCATION MAP

LEGEND:

⑧	STATION NUMBER
5 B, C, or D	QUANTITATIVE SAMPLE TAKEN AND NO OF ORGANISMS FOUND PER SQ FT
B, C, or D	QUANTITATIVE SAMPLE NOT TAKEN
25 A	QUALITATIVE SAMPLE TAKEN AND No. OF KINDS (GENERA) OF ORGANISMS FOUND

BOTTOM ORGANISMS

A	TOTAL No OF KINDS, INCLUDING TYPES B, C, & D
B	CLEAN WATER ORGANISMS FOUND IN SQ FT SAMPLE
C	INTERMEDIATE ORGANISMS FOUND IN SQ FT SAMPLE
D	POLLUTION TOLERANT ORGANISMS FOUND IN SQ FT SAMPLE

BIOLOGICAL SURVEY
POTOMAC RIVER BASIN

ROCK CREEK & TRIBUTARIES (AVERY, MD. - CONFLUENCE WITH POTOMAC RIVER)

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